AUGUST 15, 1936

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ELECTRICAL WORLD

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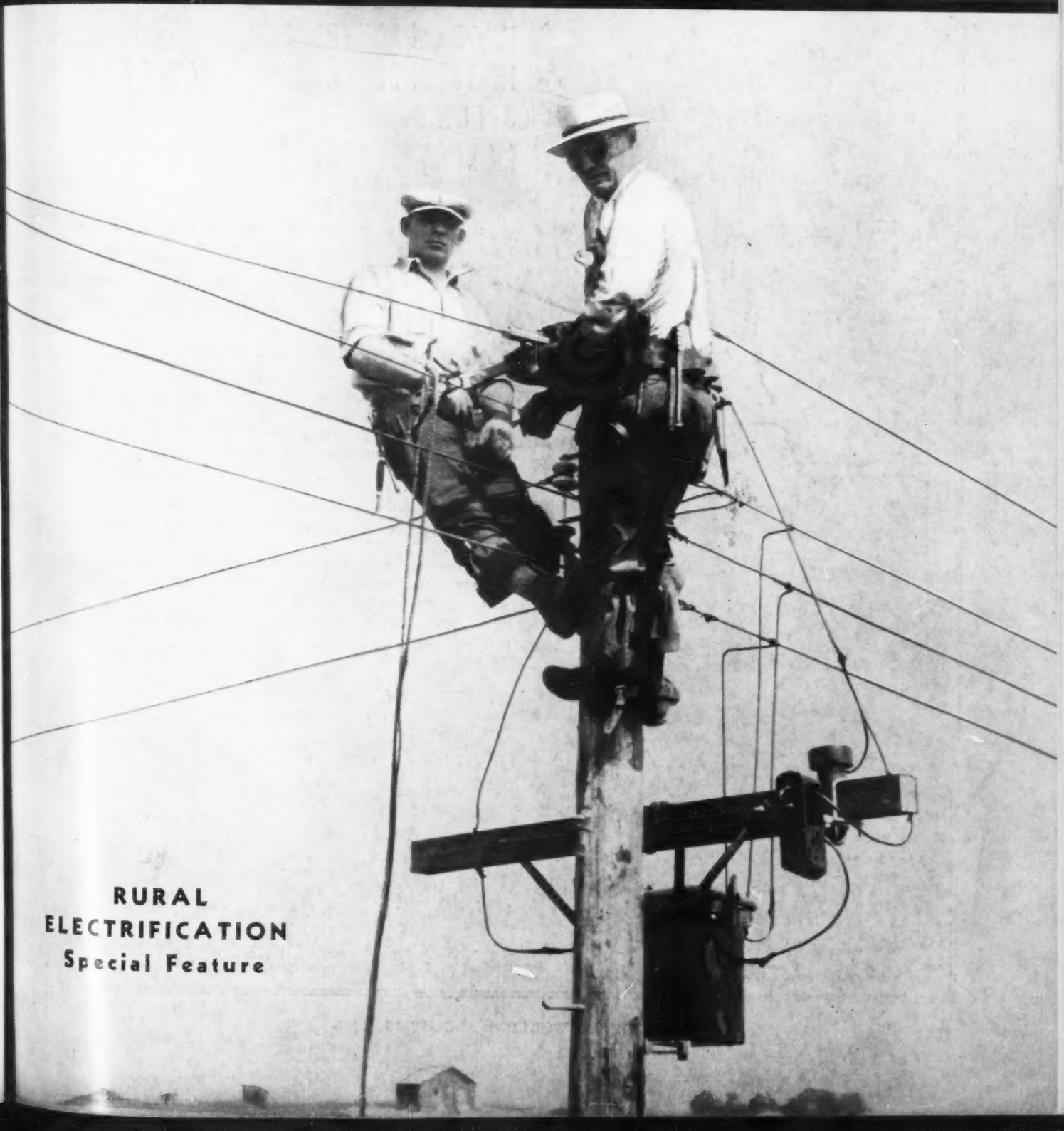

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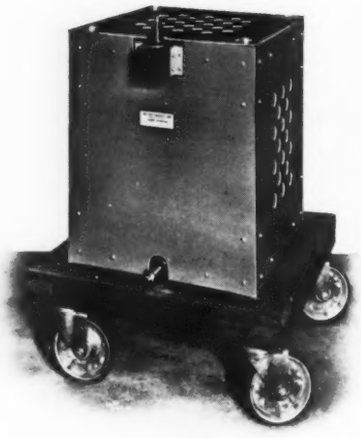
Special Feature

for Highly Specialized Testing Work

IN THE POWER PLANT
IN THE FACTORY AND
IN THE RESEARCH LABORATORY
SPECIFY
MURRAY LOW LOSS REACTORS

FIG. 1



IN THE POWER PLANT

to correct, during generator or cable testing, the leading power factor, by inserting inductive reactance in the circuit through shunt reactors across the line (Fig. 1). This shunt reactor has a 145 K.V.A. rating on a 26 K.V., 60 cycle circuit. Mounted on rubber tired wheels. Weight approx. 950 lbs.

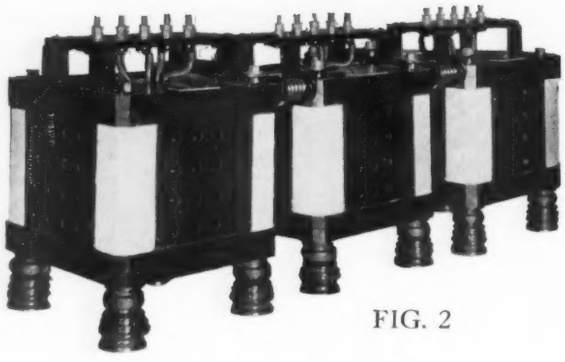


FIG. 2

IN THE FACTORY

for many routine tests on fuses, circuit breakers, etc., a multiple tap series test reactor (Fig. 2). Three single phase reactors, interbraced to withstand repelling forces between phases during short circuit tests up to 50,000 Amp. Taps on top of reactors provide for adjustment of reactance for different short circuit current values. Weight of one three phase set approx. 7200 lbs.

IN THE LABORATORY

for miscellaneous experiments—a multiple air core reactor (Fig. 3). The coils may be connected single, in series, in parallel or series parallel combinations. Coils are mounted into negligible mutual inductance relation. Used on frequencies up to 125 cycles and potentials up to 440 volts.

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MURRAY LOW LOSS REACTORS

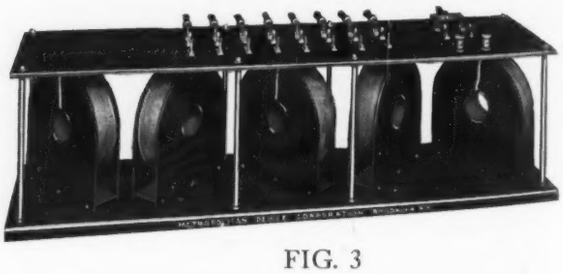

FIG. 3

ELECTRICAL WORLD

FOUNDED IN 1874 ✦ ✦ READ BY ELECTRICAL MEN FOR SIXTY YEARS

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Reader's Guide to This Issue

Current aspects of rural line construction are fully discussed by industry authorities in this issue. The subjects of economics, construction procedure and design are fully covered. Descriptive illustrations show details of typical lines built by a large number of power companies.

Of Executive Interest

New York Merchandising Plan —Rural Line Cost—Farm Line Building Practice—Oil Refineries Use More Power.

For Power Company Engineers

New Fly-Away Rural Lines—T.V.A. Rural Lines—Rural Line Cost—Farm Line Building Practices — Pre-Made Switchboard Wiring.

On Power Company Sales

Oil Refineries Use More Power —New York Merchandising Plan —Market for New Load Center.

For Electrical Engineers

Wide Market for New Load Center — Pre-Made Switchboard Wiring — Oil Refineries Use More Power

For Electrical Manufacturers

Pre-Made Switchboard Wiring—Wide Market for New Load Center—New York Merchandising Plan—Oil Refineries Use More Power—Farm Line Building Practices—Rural Line Cost—T.V.A. Rural Lines.

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Coming Features

World Power Conference

In advance of the Third World Power Conference, to be held in Washington, D. C., September 7-12, ELECTRICAL WORLD will present in its August 29 issue a summary of American power practice. Articles discussing outstanding American power plants and distribution systems will be presented, together with a summary of power statistics and other related subjects of interest to visiting engineers. An eight-page map of the national power system will be featured. A full report of the conference will be in a following issue.

Draft Tube Design Improved

Interesting model investigations conducted by U. S. Army engineers in connection with the draft tube design for 60,000-hp. Bonneville turbine units will be described in an article by Howard L. Cooper, who is connected with the Bonneville Project.

Modernized Electric Furnaces

Heat-treating processes in the plant of the Boeing Aircraft Company have been completely modernized. Details of the new installations are to be given by E. P. Dean, plant engineer, who will tell what the new equipment will do.

Graphic Instruments Sell Power

Frank E. Wiatt explains how the Union Gas & Electric Company is making use of graphic instruments to sell power and keep it sold. Cases are cited describing the most interesting jobs.

Phase Angle Recorders

Principles behind the operation of new phase angle recorders being used at Hell Gate and Hudson Avenue stations of the Consolidated Edison Company, Inc., are discussed in this article, which also describes alternate methods considered.

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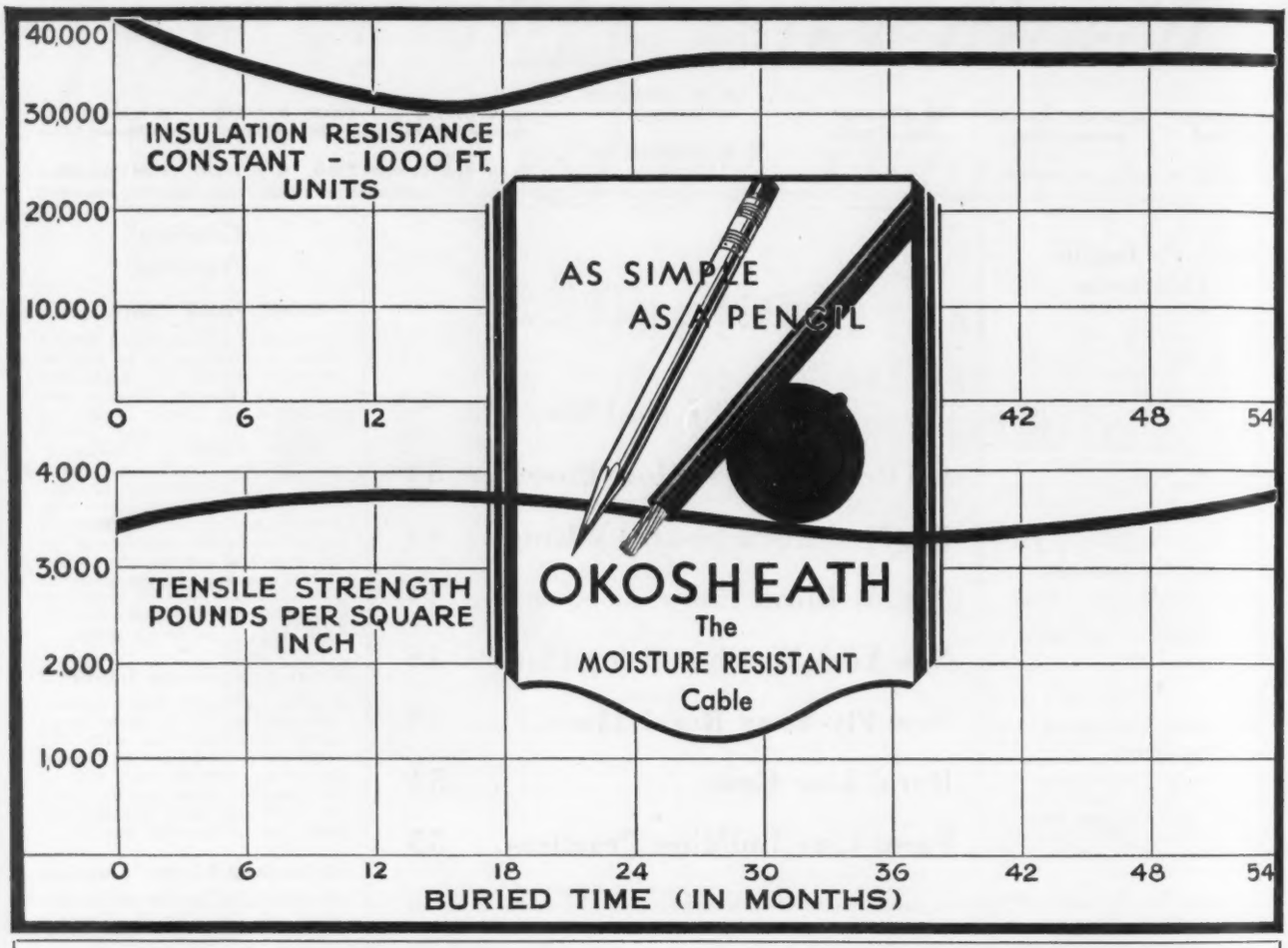

The excellent moisture resistance of Okosheath cable is shown by the above curves. These show the results obtained on a length of standard, single conductor No. 4/0 A. W. G., 600 volt Okosheath cable which has been buried in *wet ground* for five years. It was removed periodically and tested after twelve hours immersion in water.

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Note: The above chart appears in our latest booklet on Okosheath, which will be mailed upon request.

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PUBLISHED EVERY SATURDAY

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Dog Days Are Busy Days

A look at the present power output gives an indication of what the electrical industry faces. All records continue to be broken. In anticipation of coming load, utilities are busy with negotiations for new capacity. Manufacturers already feel the pressure for early delivery of turbines. Latecomers will get late service.

It is unfortunate that no settled policy exists with respect to the power presently to be available from federal projects. Apparently the Administration has no program except to build plants. Adjacent utilities would buy this power at a fair price, but if this is not possible they would install more capacity. It is the uncertainty that will make the public suffer through curtailment of service.

A typical situation is the news that T.V.A. will abrogate its non-competitive contract with the adjacent utilities. This apparently is a preliminary to an invasion of their territories and destructive competition. It is a political and opinionated approach to power supply. We doubt if the majority of the T.V.A. Board favors this policy or that it will be carried out. There is going to be a showdown on T.V.A., and that soon.

As part of this general power picture the World Power Conference is certain to have an influence. This will be meeting in Washington. Papers will be presented by titles only. Discussion will be open. Undoubtedly press releases will reflect pro and con opinions on national power policies. The Administration will have its press agents present and at work. How is the industry planning to handle this aspect of the conference?

One exhibit of the conference is a model electrified farm. We have far better samples available that have been in operation for some years. But attention on the building of rural lines in mass volume should not obscure the major point about rural electrification as illustrated by this and other electrified farms. This is the very difficult task of getting farmers to use any large amount of electricity. The only way to reduce the unit cost of rural service is to get a large use of energy.

Significant indicators of a large increase in power use by industry is the present shortage of skilled labor and the high prices of all labor. Even the P.W.A. finds that skilled labor is gone from relief rolls, and yet the President has ruled that relief labor be used on P.W.A. projects. Industrial plants of all types find a skilled labor shortage. They are doing two things to meet the condition. One is to revive apprenticeship courses and the other is to use more power and more machines. Instead of a man per machine industry is using several machines per man. Thus do economic facts force industrial adjustments.

Conventions of several branches and groups in the industry are scheduled for September and October. A glance at the programs shows that the industry is hard at work capitalizing upon its new opportunities. We hope there will be a big turn-out at all these meetings. They should be informative and stimulating, for at last men of the industry can report something done and suggest something to do. In a time of action conventions pay dividends.

This story of power and increased activity in the field would not be complete without a glance at the balance sheets and financial markets. These give a corresponding picture of a more encouraging situation. Security prices are on the upgrade. Credit is good, as reflected in refunding operations. Earnings are increasing steadily. There is no cloud on the financial horizon. We doubt if the industry ever had such an encouraging business picture in the middle of August as that now shown on the screen.

Fred Morrow

Editor

WORLD POWER DELEGATES WILL VISIT U. S. PLANTS

Above—Richmond station, Philadelphia Electric Company

Below—Hudson Avenue station, Brooklyn Edison Company

Oil Refineries Using More Electric Power

Recent Developments in Equipment for Safety and Economy Influence the Decision on Utilization of Water for Power Production

Explosion-proof equipment, gearmotors, unit assemblies of motors and centrifugal pumps, variable speed a.c. drive are among recent developments that increase desirability of electric applications. Purchased power encounters stiff competition in the refinery field, but has the very important advantage of requiring small investment by the customer.

By RICHARD HENRY

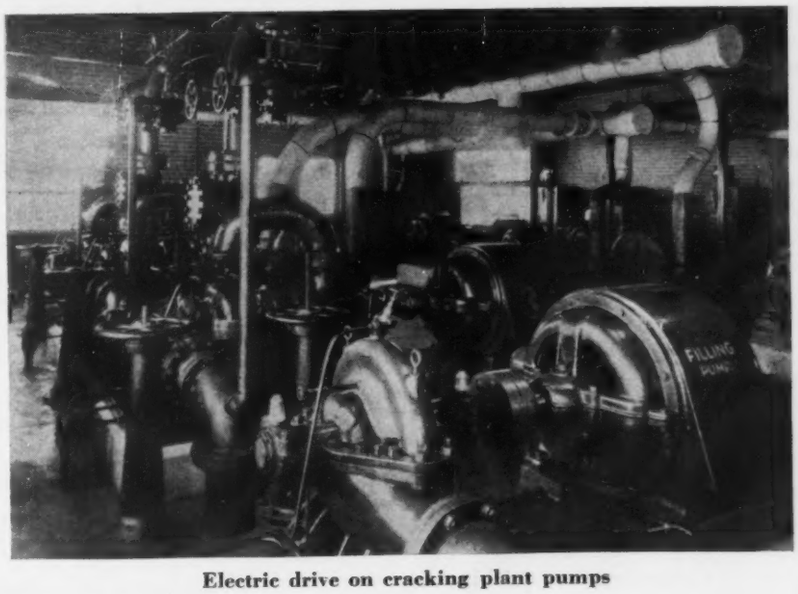
Refinery Engineer, Empire Oil & Refining Company, Tulsa, Okla.*

DUE to the large variety of oil refineries existing today, it is almost impossible to arrive at average figures for the power requirements of a refinery of any given capacity. Differences between plants are caused by type of crude, throughput capacity, kind of equipment in service, state of modernization, kinds of products and local conditions. In order, therefore, to give some idea of how much power is required, where it is used and what kind is most suitable, it is necessary to cite specific cases, two of which are presented here, as typical plants. The difference between them is that one includes lubricating oil production and the other does not.

In all refineries certain numbers and quantities of so-called waste fuels are produced. These products are commonly classified as coke, unsalable fuel oil, acid sludge and refinery gas, and they must be disposed of in some manner. There is usually a ready market for coke at a price which makes it uneconomical as refinery fuel. Also, the other available fuels can be handled much more easily and conveniently, and a refinery is usually so congested that it is very expensive to handle fuel in solid form. The unsalable fuel oil and acid sludge get first call as refinery fuel because it is very difficult and expensive to dispose of them in any other way. Refinery gas, which is the most convenient and easiest to handle, is used after all unsalable fuel oil and acid sludge have been disposed of. Oftentimes, it is possible to sell all or at least the excess refinery gas at a fairly attractive price.

In the first typical plant cited all of the coke is sold, all of the unsalable fuel oil and acid sludge are burned and a portion of the refinery gas is burned. The remainder of the refinery gas is sold, otherwise it might be used advantageously to generate steam power, which would replace purchased electric power, or it might possibly be used to generate electric power. In the second typical plant all of the coke is sold and all of the three other waste fuels are used as refinery fuel. The waste fuels available are not quite sufficient to supply the plant fuel demand, making it necessary to furnish the plant with a small amount of salable fuel. The explanation for this condition is that the lubricating oil production consumes considerably more fuel than is produced as waste by it.

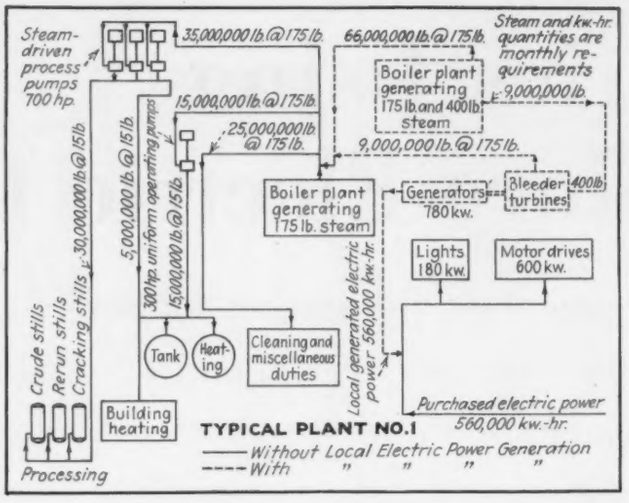
The purchased electric power requirements of these two typical refineries would not be nearly so great if it were not for recent developments in electric equipment, perhaps the most important of which is that of explosion-proof motors and switches. The



Electric drive on cracking plant pumps

* Based on paper to Petroleum Electric Power Club.

This typical refinery has a crude capacity of approximately 23,000 bbl. daily and is classed as a skimming and cracking plant; that is, its production consists primarily of gasoline and fuel oils. The figures and quantities here used may be considered as fairly representative averages, but are subject to approximately 30 per cent variation either upward or downward, depending upon the particular plant, the operating conditions and the amount of throughput. The process and heating requirements are approximately 50,000,000 lb. of steam per month. Of this quantity 60 per cent is needed for processing and the remaining 40 per cent for heating. Low-pressure steam (10 to 15 lb.) is entirely suitable for these duties. Because it costs so little more to produce this steam at 150 to 175 lb. or even higher, a considerable availability of power is thus created. Most of this is steam power, which cannot under any conditions be economically replaced with electricity, and which in this particular case amounts to approximately 1,000 hp. About 35,000,000 lb. of this low cost power steam can be readily used, not only because it is economical from a cost standpoint, but also because it gives flexibility and better operation on certain equipment. The remaining 15,000,000 lb. can be economically used for power purposes on duties which could be handled satisfactorily by either steam or electric power.


Steam-driven process pumps 700 hp.
35,000,000 lb. @ 175 lb.
66,000,000 lb. @ 175 lb.
Steam and kw.-hr. quantities are monthly requirements
Boiler plant generating 175 lb. and 400 lb. steam
9,000,000 lb.
15,000,000 lb. @ 175 lb.
25,000,000 lb. @ 175 lb.
9,000,000 lb. @ 175 lb.
Boiler plant generating 175 lb. steam
Generators 780 kw.
Bleeder turbines
400 lb.
Lights 180 kw.
Motor drives 600 kw.
Local generated electric power 560,000 kw.-hr.
Purchased electric power 560,000 kw.-hr.
Tank
Heating
Cleaning and miscellaneous duties
Building heating
Crude stills
Rerun stills
Cracking stills
30,000,000 lb. @ 15 lb.
5,000,000 lb. @ 15 lb.
300 hp. uniform operating pumps
15,000,000 lb. @ 15 lb.
Processing
TYPICAL PLANT NO. 1
Without Local Electric Power Generation
With " " " "

Flexibility of drive is of the utmost importance on those pumping duties which are integral parts of some processes. In this plant this applies particularly to the crude, rerun and cracking units, which at various times run on different charging stocks, under different conditions and at different capacities. Even if low cost steam were not available, it would be imperative in most plants to produce steam for these duties in order to insure satisfactory operation, which would be difficult to obtain with electric motor drives.

In addition to process and heating, approximately 25,000,000 lb. of high-pressure steam is required per month for cleaning and miscellaneous uses. This makes the monthly steam requirements of this plant total 75,000,000 lb., 60,000,000 lb. of which could not be replaced by electric power either practically or economically and 15,000,000 lb. of which could be replaced by electric power practically, but not economically.

The additional power required in this plant for other duties approximates 1,000 hp. needed for light and for driving pumps, compressors and mechanical devices of various kinds, which are not integral parts of processes, but which are operated almost continuously under uniform conditions. With the exception of lights, small drives and drives in outlying locations, all of this load can be practically handled by steam power as well as electric power, and the choice can be made strictly on an economic basis. Because of attractive rates, the choice of this particular plant has been purchased electric power and the average monthly consumption is about 560,000 kw.-hr.

For the purpose of comparing these power requirements with those of the second typical plant, it is best to express these requirements on a per barrel throughput basis. It is, therefore, found that the steam power requirements of this plant amount to 100 lb. per barrel of crude run, and the purchased electric power requirements are 0.8 kw.-hr. per barrel.

The dotted lines represent the possible competition with purchased power, indicating the additional installation.

Electric power in a gasoline and fuel oil refinery

availability of such equipment has made it possible to utilize electric power almost exclusively where it proves economical in lubricating oil plants, in which formerly it was prohibited because of the danger of disastrous fire from motor or switch flashes. This hazard is due to the presence of explosive vapors, which heretofore it has been impossible to prevent from escaping in greater or less degree. In spite of much better means for confining these vapors, recently devised, there is still a potential hazard and the necessity for explosion-proof equipment is by no means lessened.

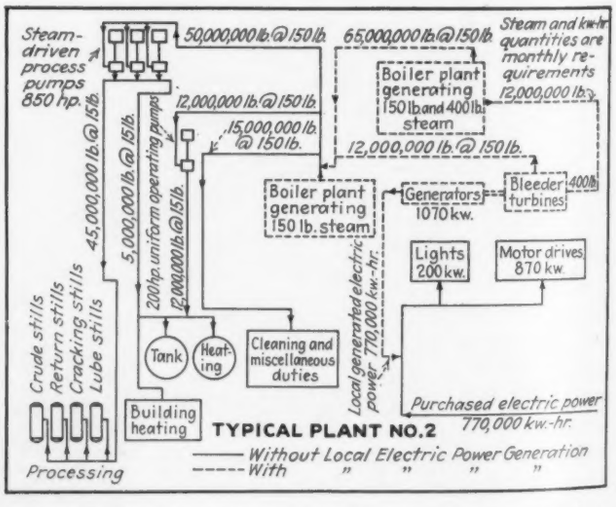
Another development which has enlarged the use of electric power in refineries is the gearmotor, which is much less in cost than a separate motor and speed reducer or increaser. Other distinct advantages of this compact unit are lower installation cost and smaller space requirement. These factors frequently are of sufficient weight to make electric drive more economical than steam.

Still another development with the same advantages is the combined centrifugal pump and motor unit. It is recalled that when this development was first placed on the market it was available only with an open type motor. The manufacturers quickly realized that its use in refineries would be seriously restricted if it could not be furnished with an explosion-proof motor. Consequently, it was immediately made available in either type.

The most recent development which promotes the use of electric power in refineries and which should be of considerable interest to operators is that of an efficient and practical variable-speed motor, commonly referred to as a brush-shifting motor. A number of these motors have been installed in several plants as drivers for centrifugal hot oil pumps serving cracking stills. This is a duty which requires

The second typical plant has a crude capacity of approximately 9,000 bbl. daily and is classed as a skimming, cracking and lube oil plant; that is, its production consists primarily of gasolines, fuel oils and lubricating oils. The non-replaceable steam power requirements of this plant are 65,000,000 lb. per month and the additional power load required approximates 1,500 hp. Of this, 200 hp. must be supplied by steam because of the necessity for flexibility or because of economics, or because of both; therefore, the total monthly steam power requirements are 77,000,000 lb. and the total additional power needed is 1,300 hp. As in the first typical plant, purchased electric power was chosen for this load and the average monthly consumption approximates 770,000 kw.-hr.

On a unit basis, the steam power requirements of this plant, which includes lubricating oil facilities, amount to 285 lb. per barrel of crude run, and the purchased electric power requirements are 2.85 kw.-hr. per barrel. Considering that the second typical plant maintains a lower steam pressure than the first and has a less efficient steam distribution system, it is concluded that the addition of lubricating oil facilities approximately doubles the amount of steam power required and triples the amount of electric power required in this type of refinery.



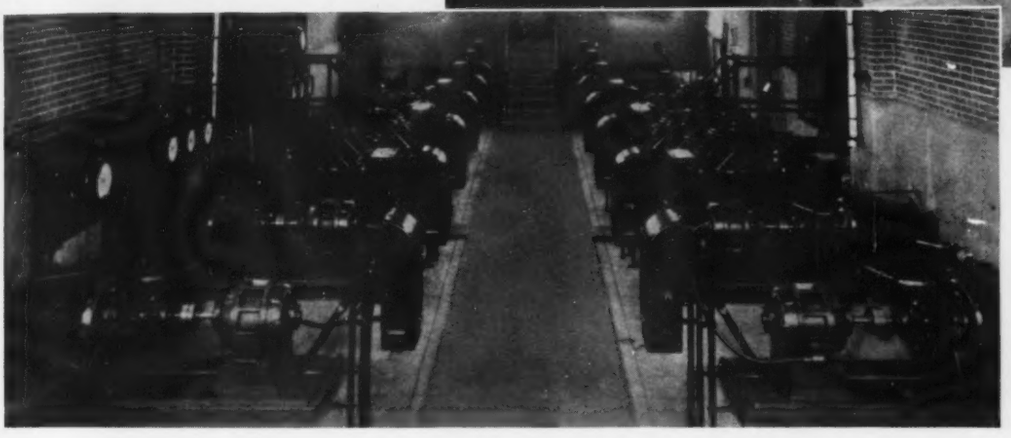
Lubricating oil production raises power requirements

from 300 to 700 hp., depending on the size of the still and the method of operation. In addition to the variable-speed motor's adaptability as a centrifugal pump driver, it should also find uses on power pump applications.

Although there is a definite need for a motor of this type, it has some disadvantages which cannot be ignored. On a horsepower basis this equipment costs approximately three times as much as the conventional type motor. Also the maximum speed for which these brush-shifting motors have been built to date is around 1,000 to 1,200 revolutions per minute, which limits their use to some extent unless speed increasers are provided. Furthermore, it is found that centrifugal pumps generally do not perform satisfactorily when there is an appreciable quantity of coke in the material to be handled. This automatically eliminates the possibility of using this kind of pumping unit on those cracking units which are run to coke, unless the coke can be satisfactorily screened out before it reaches the pump.

Boiler feed and filter wash pumps

For pumping light oil



A very important factor concerning the application of motor drive to cracking unit hot oil pumping is the necessity to provide protection against shutdowns because of power failures. An emergency shutdown of a cracking still not only results in complete loss of production but also extremely high coke cleaning costs. As long as there is a possibility of power failure, it is almost imperative to install a steam drive standby, which, of course, increases the initial costs and makes the electric drive more difficult to justify.

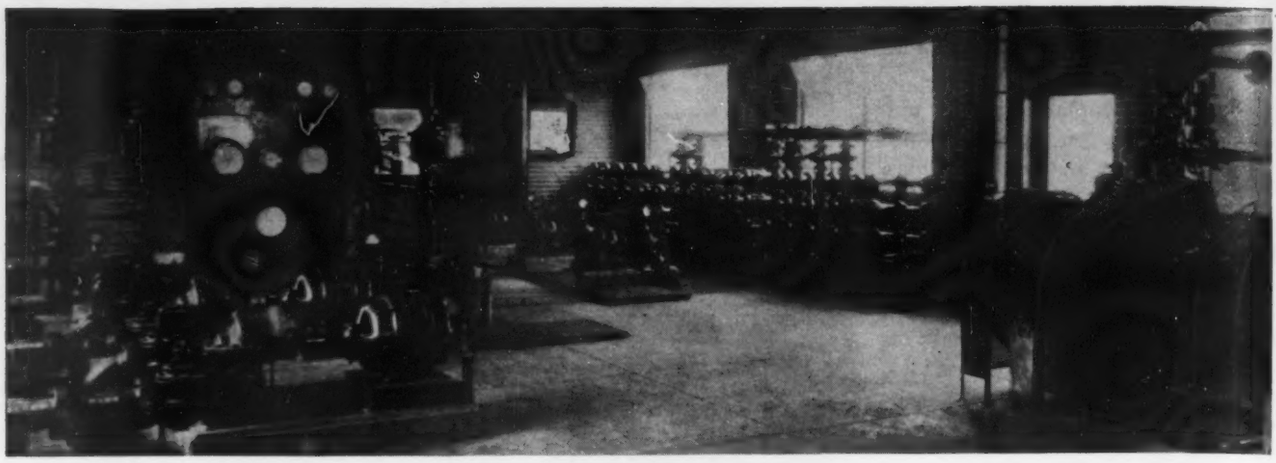
The cracking unit hot oil pumping duty requires, perhaps, the greatest amount of power of any single duty in a refinery. It is believed that in general operation it will be more satisfactory and more economical from an over-all standpoint if steam instead of electric power is used. Whatever economies might be shown by a motor drive would be in most cases more than offset by inflexibility, just as is the case on other power duties which are integral parts of processes.

The electric power consumed in the two typical plants, or in any plant, is used because it has advantages over steam power. The first of these advantages lies in the simplicity, small space requirement and low purchase and installation cost of electric power equipment. These factors are of immense importance in refineries where, in general, equipment is massive, complicated and congested. A second advantage is the low maintenance expense required. A third advantage is high efficiency, which cannot be approached by steam drive.

On the other hand, there are definite disadvantages to the use of electric power. Perhaps the most important of these is the matter of service continuity. Too much emphasis cannot be placed on the necessity for uninterrupted service. Forced shutdowns from other causes are frequent and costly enough, without having to contend with additional ones because of power failures. This disadvantage applies to refinery-generated power, as well as to purchased.

A second disadvantage is the lack of flexibility, which has already been mentioned several times and which prevents quite a number of pumping duties from being handled very satisfactorily or economically with electric power. These may be classified as transfer or miscellaneous duties, and consist for the most part of transferring various products from one plant locality to another, or from the vicinity of one facility to that of another, for further processing or handling. As one pumping unit usually handles several different duties, it is apparent that the pumping conditions change over a wide range, making the use of centrifugal pumps impractical and inefficient. In addition, there are other pumping duties involving the unplugging of coked-up lines, the handling of very light products under high pressures and the handling of dirty materials which can best be handled by steam-driven reciprocating pumps.

There is a factor which always has and always will make purchased electric power unattractive to oil refineries,



Treating plant pump room

and to every other consumer, and that is the bill which comes in the first of every month. For a plant of any size, the monthly bill runs into several thousand dollars and is classified under the heading of cash outlay. This is an item which has been subjected to a lot of punishment, particularly in the past few years. It has not been unusual for some project of a more desirable design to be cast aside for one not so good, for the simple reason that the latter required a substantially lower cash outlay. This factor is one which applies directly to the purchase of electric power and is a problem which will always confront the power companies.

The cash outlay required for the purchase of electric power and the unavoidable production of waste fuels are the two primary factors which make refiners give serious consideration to the possibilities of generating their own electric power. It is rather difficult to discuss power generation in a general way, as each plant has a separate and distinct problem of its own. The saving or return which can be realized from a generating plant investment is dependent upon the type and size of plant, available equipment, quantity of power required, amount and value of fuel which can be utilized, existing power rates, and perhaps still other factors. All, or at least most, of these factors are different for different plants.

It is possible for refineries to generate their own power by means of Diesel engines, gas engines, steam turbines and gas turbines. Diesel and gas engines can probably be justified in some plants where the power requirements are small and where boiler capacity is inadequate for generating power, but they can rarely be justified in large plants where a number of large units are required, because of the high initial costs. Even if power can be generated by means of engines at a lower cost than it can be purchased, the fixed charges incident to the high investment costs make such a project unattractive.

Bleed turbine has appeal

Usually the best means of producing electric power is by the use of bleeder-type turbines supplied with steam at a pressure of 400 lb. or more. Steam at this pressure can be used for both power generation and plant requirements. The method of operation is to supply the generating turbines with high pressure steam and take a bleed off at 150 or 250 lb. for plant use. This means that the actual cost of generating power is only the difference between the costs of generating high-pressure and plant-requirement steam. This actual cost is very small, but it is necessary to install the high-pressure boilers if they are not already in, and this usually increases the investment costs to a figure which makes it impossible to justify the project.

The means last mentioned for generating power is the gas turbine-driven generator. Power is derived by utilizing the approximately 100-lb. pressure drop on the gas produced from cracking stills. Usually, such a drop is taken anyway before this material is processed through an absorption plant. The advantage in this kind of equipment is that it costs nothing actually to produce power. The disadvantages are that the supply of gas fluctuates over a wide range with zero minimum, and the amount and pressure drop of the gas is sufficient to supply only a portion of the power required by the plant. One such unit of this kind would probably fit in very nicely with a steam turbine-generating scheme and tend to improve the over-all cost picture from an operating standoint.

The principal objection to a refinery installing an electric power generating plant of any kind is the large initial investment required. The high initial cost is due largely to the necessity for installing sufficient capacity to take care of peak demands and breakdowns. Cost of standby equipment alone normally represents approximately 30 per cent of the entire cost. The high initial cost is not objected to strictly because of the expenditure required for the purchase and installation of equipment, but also because of the fixed charges, which must be considered in the same category as the power bill.

If a new refinery is being erected, or if an existing refinery is having its boiler facilities substantially expanded, electric power generation facilitates can probably be justified and a reasonable saving or return realized. If neither of these conditions applies, an economical justification would rarely prevail unless the average rate of purchased electric power exceeds a range of from 8 to 12 mills per kilowatt-hour. This might be classed as a border line rate range. In other words, refineries paying a rate within this range are constantly analyzing the possibilities of generating their own electric power, some of them concluding it would be profitable and others finding it not profitable. This means that any appreciable rate increase or decrease would have a corresponding effect on power generation possibilities.

Pre-make Switchboard Wiring on Panel Template

New Wiring Scheme Permits the Panel Fabrication and Wiring to Be Done Separately and Assembled as Units

By A. E. ANDERSON

Panel and Equipment Division, General Electric Company, Philadelphia, Pa.

MODERN switchboards designed as compact assembled units have made the need felt for a wiring method which utilized a minimum amount of panel space, without sacrificing maintenance and inspection facilities. Such a scheme has been developed in which wiring and assembly originate from the same drawing, but are carried through the factory concurrently, unlike the older method in which wiring followed assembly of the devices. Furthermore, the panel, rather than the switchboard, forms the manufacturing unit. The combined effect of these two items is to reduce the time required to manufacture a switchboard and to smooth out production peaks so as to increase manufacturing efficiency.

Under the new scheme all panel wiring is formed on a table above a template. Since the wiring template is made simultaneously with the drilling template, agreement is obtained in stud locations and sizes, openings, etc. Additional data relative to the location of panel wires, miscellaneous back-of-board devices and supports and other information are contained on the template. On the working table wiring supports, together with all required hardware, are applied as specified on the face of the template.

Inclosures formed by supports on either one or both borders of the panel are used for the long vertical runs. For short runs jumpers are carried directly between terminals, grouped together and banded at intervals. Connections between widely separated terminals are first carried horizontally across the panel and then through the vertical support into the wiring inclosure. The support contains a large number of holes which not only provide a method of mounting numerous back-of-board devices but also provide for holding the wires in place.

Switchboard consisting of pre-assembled panels

Wiring supports and covers house vertical run wiring on finished switchboard. Horizontal cross trough provides for panel interconnections.

Table wiring for switchboard panel showing wiring template, support and dummy devices

Since the working surface is horizontal, the wireman is in a more comfortable position and has more ready access to the various devices and terminals. Studs and terminals of all devices mounted on the front of the panel are represented by dummy studs or terminals or a dummy of the device is used in its correct location, without requiring the presence of the device or the panel.

Upon completion of all connections, the support, together with associated wires and devices, is removed from the table and hung on a storage rack. In the meantime the panel is being fabricated and the front-of-panel devices

[*Continued on page 90*]

T.V.A. Rural Lines

Long-Span, Common-Neutral, 11,900-Volt, Four-Wire System Adopted — Crossarms Omitted — Single-Bushing Transformers

By LLEWELLYN EVANS . . . H. C. DANIELS . . . T. G. BURKE
Engineering Department, T.V.A.

ON THE inauguration of the Tennessee Valley Authority, in the fall of 1933, there was an urgent demand to begin immediate construction of rural electric lines to aid in relief of the acute unemployment situation. Meeting this demand in the short time in which work was started left little time for design and study. Suppliers' stocks of standard materials for the conventional crossarm type of construction for both primary and secondary circuits were used to avoid delay in beginning construction. At the same time longer range planning was begun. Surveys of the territory to be served showed a low prospective customer density, and in order to make it feasible to furnish electric service to the largest possible part of the rural population it immediately became evident that the cost of distribution, in its broad sense, would be the deciding factor in the extent and success of the program. This criterion presented the following problems for solution:

1. Low investment.
2. Rugged and durable construction.
3. Low operating and maintenance costs.
4. Suitable for long distances.
5. Single-phase line expandable to three phase.

The type of construction now being used by T.V.A. on rural distribution lines is the result of continuous investigation and practical application in the solution of these problems to reach the lowest total annual cost of distribution consistent with a high quality of service. The same engineering and design practices used in 154-kv. heavy-duty lines were applied to the perfection of rural distribution standards.

A rural distribution voltage of 11,950-volt, four-wire primaries (6,900 volts to ground) and a common neutral for both primaries and secondaries was adopted. A lower voltage was not suitable for the long length of lines required.

Economical construction dictated the use of long spans. The nature of the country is such that with high-strength conductors spans averaging about 400 ft. could be obtained normally with 30- and 35-ft. poles and with a minimum of guying.

The long-span construction required a more than ordinary separation of conductors. The nature of the load required a three-phase trunk line out into most rural areas and between towns and villages to supply the occasional cotton gin, grist mill and other small power loads. However, by far the larger mileage of lines required to serve the rural residential consumers is for only single-phase lateral branches from the main supply lines. A study of these requirements led to the selection of a pole-top pin type of construction with one phase wire on top of the pole and the common neutral carried by a secondary bracket on the side of the pole below. A minimum of hardware is required, all of which can be attached on the ground, thus reducing work in the air to a minimum, and the spacing is such that a standard 8-ft. distribution crossarm can be installed at the bottom of the pole-top pin to support two additional primary wires when desired, without disturbing the wires already in place.

Secondary on spools

Each secondary wire, as well as the common neutral, is supported by a special spool bolt with a standard secondary spool insulator, which is held in the horizontal position, thus making an ideal conductor support for long-span construction. A single-phase primary line can be changed to a three-phase line and secondary wires added without disturbing the original circuit. Bare wire is used throughout and a minimum vertical spacing of 18 in. between secondary wires is maintained. The addition of one secondary wire to a standard single- or three-phase primary line provides a two-wire secondary circuit. Secondary dead-end clevises which attach to either end of the spool bolts provide great flexibility and require a minimum number of inexpensive parts for making service attachments and for turning angles.

Extensive investigation and study resulted in the development of a single bushing type distribution transformer with the primary and secondary neutrals grounded to the tank and connected through a secondary bushing to the neutral conductor and ground. The transformer fuse is mounted on top of the single primary bushing and a voltage limiting gap installed between the incoming primary wire and the grounded transformer tank so that an arc across the gap will not blow the transformer fuse. The transformer mounting is so arranged that the transformer may be hung at any desired position around the circumference of the pole with one bolt and one lag screw. Close co-operation with manufacturers made the mass production of this transformer possible.

No insulators are used in guy wires and each guy wire is bonded to the common neutral at the pole to improve the neutral ground connection.

In order to minimize the time of outages due to arc-over of insulators or of the transformer protective gaps all rural trunk feeder lines are equipped with high-speed automatic reclosing oil circuit breakers. These oil circuit breakers are normally set to reclose instantaneously on the first trip-out and at intervals of 14 and 45 seconds on the second and third trip-outs, respectively. In addition, the branch lines off the trunk lines are equipped with expulsion type fused switches to clear them in case of permanent trouble without interrupting service on the trunk lines and also for use as sectionalizing points to facilitate the location of line faults. Branch

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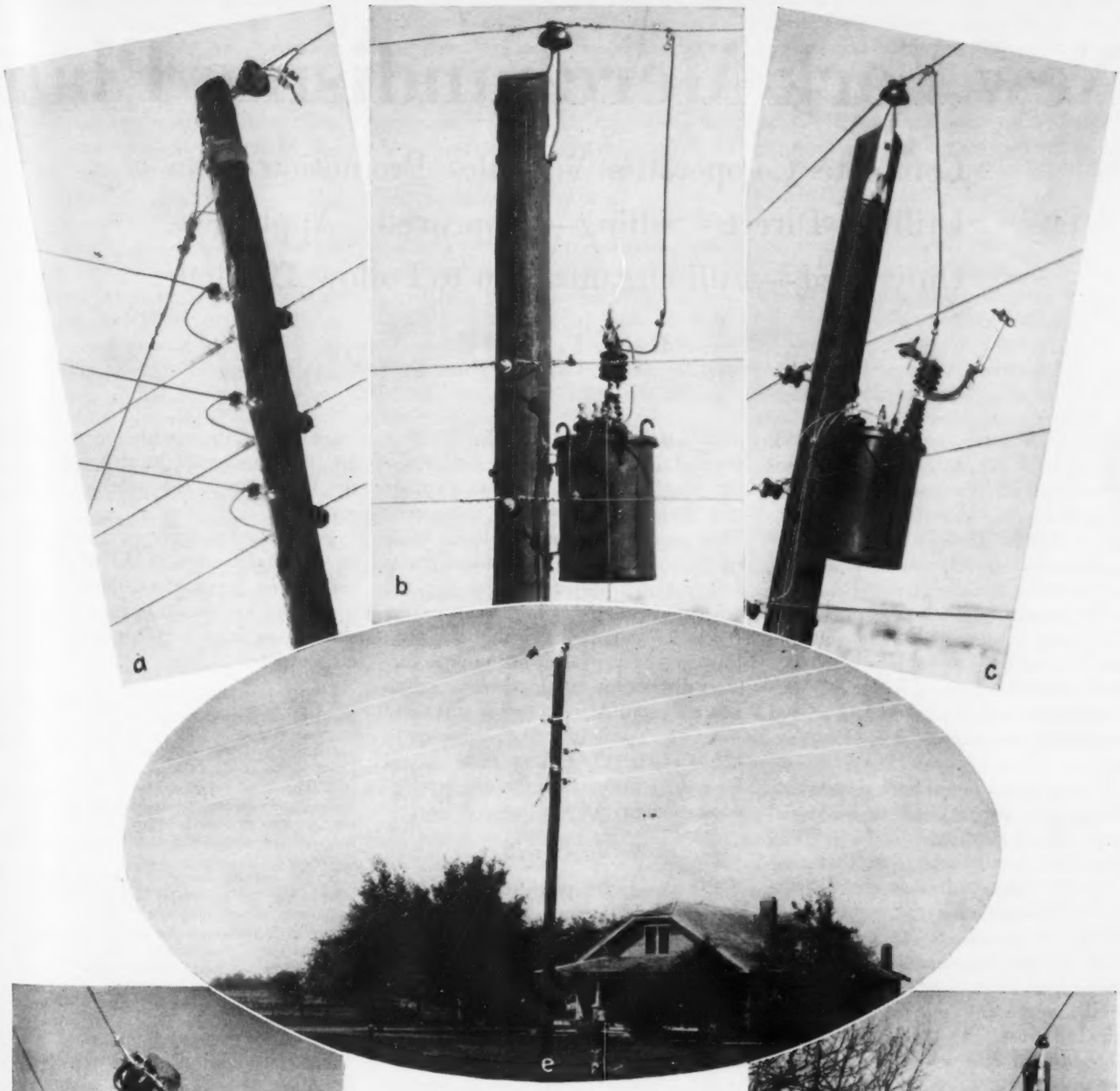


Typical Pole-Top Construction on T.V.A. Rural Lines

(a) Single-phase primary dead-end and continuous three-wire secondary with three-wire service connection. Neutral is bonded to guy wire. Insulated clevises on back end of secondary spool bolts provide attachments for service wires. (b) Transformer installation showing transformer fuse in open position mounted on top of primary bushing with protective gap between line and tank. Primary and secondary neutrals are grounded to tank and solidly connected to common neutral conductor and ground. (c) Same installation as in (b), but showing details of secondary transformer connections. (d) Expulsion type fuse switch on primary branch circuit automatically opens circuit on faults for sectionalizing. (e) Single-phase primary circuit showing continuous common neutral and two-wire secondary dead-end with two-wire service drop. (f) Single-phase primary circuit, 6,900 volts to ground, with phase wire on pole-top pin and grounded neutral on spool below. Two primary wires can be added by using a crossarm in the top gain. Note minimum amount of tree trimming to keep line clear.

New York Merchandising Plan

Complete Co-operation in Sales Promotion—No Utility Direct Selling—Approved Appliances Only Used—Full Organization to Follow Through

By E. F. JEFFE
Assistant Vice-President New York Edison Company

IN THE latter part of May, 1935, with the aid of the Electrical Association of New York, a meeting of manufacturers, distributors, jobbers and a limited group of electrical appliance dealers was called to discuss an alternate for direct merchandising of appliances by the New York Edison Company, in that such merchandising was discontinued as of June 30, 1933. A Co-operative Plan of Electrical Merchandising, which to date has proved successful, was presented at this meeting.

The presentation of such a merchandising plan necessitated, as an initial step, the determination of the field open for development. At that time available data indicated that of the 8,015,000 bills rendered annually for residential usage 5,897,000, or 74 per cent, were for less than 44 kw.-hr., indicating the large field that was open to the aggressive sale of home electrical devices. There was a definite place to go and a definite field for action.

It was felt that through the close coordination and co-operation of the utility, the manufacturer, the distributor and the retail electrical appliance merchant home electrical appliances could be successfully presented as an integral part of the life of the average family. Use of these appliances must be advocated as something that touches personal convenience and happiness intimately and forcefully, and if this could be done through proper canvass of the available field, it seemed clear that the consistent and rapid growth of electrical radio installations could be duplicated by many other home electrical devices.

The Co-operative Merchandising Plan of the New York Edison Company, as effective May 28, 1935, is based on a partnership between the utility, the manufacturer, the distributor and the retail appliance dealer, for the benefit of these business partners and their customers—the consumers. This co-operative plan places upon each of these business partners duties and specific obligations as to each other and equally as to the consumers. It was a recognized fact that the weak link in the consumer-utility-manufacturer-distributor-retail dealer set-up was the retail dealers, and that if there was to be a satisfactory distribution of home electrical devices steps would have to be undertaken for the development of the retail appliance dealer.

No direct selling

Phases of the plan were new and completely different. It provided that the New York Edison Company appliance showrooms would be equipped with the latest and most modern home electrical devices and be manned by qualified personnel, trained not only in the methods of selling home electrical devices but also in the proper application and use of same; that the New York Edison Company, which had discontinued the sale of home electrical devices from the standpoint of making profit on such transactions, would arrange that the available profit be reserved for the retail electrical appliance dealers established throughout the company's territory; that these electrical appliance dealers would, in turn, be qualified and trained so that in all details they could offer consumers the same services which could be obtained directly from the utility company; that the New York Edison Company would take orders for such appliances and electrical equipment as are displayed and demonstrated in its various showrooms, and that such orders would be transmitted to the manufacturer or distributor, who, in turn, would place them with the approved appliance merchant located nearest to the residence of the purchasing consumer.

Promptness of delivery is considered an essential feature of the set-up. To insure this promptness, the following procedure was set up in the company's showrooms for the execution of appliance orders:

1. The demonstrator making the sale prepares five copies of the order form which the purchaser signs. One copy is given to the purchaser and one copy remains in the order book.
2. The three other copies of the order are immediately given to the demonstrator in charge, who at once telephones the manufacturer of the appliance or his agent, placing the order.
3. The manufacturer in turn immediately telephones the approved dealer, who is required to make prompt delivery. If question of credit is involved, the dealer immediately contacts the customer and secures the credit information necessary for delivery.
4. After making delivery, the dealer sends a copy of the delivery receipt to the domestic appliance promotion bureau of the company.

The routine provides for written confirmation of the orders so telephoned and for a follow-up system to check deliveries. Of the three copies given to the demonstrator in charge at the time of the sale, two copies are mailed to the manufacturer and one copy is forwarded to the manager of the company's domestic appliance promotion bureau for record and follow-up purposes.

It is the function of the domestic appliance promotion bureau to follow each order to establish definitely that delivery has been made, or, in the failure of delivery, to determine the cause of the failure. In any event, contact is made at a later date by a company sales representative to determine the customer's satisfaction with the use of the appliance.

Constant supervision of the plan has been mentioned by the company. Dis-

tributors have not been permitted to give orders at random to whichever dealer they desired. They have not been permitted to take the line of least resistance and give orders only to those of established credit and those carrying large inventories of merchandise. The plan has not permitted the wielding of such sales "clubs." The home electrical appliance dealer having his place of business in a sparsely settled section or in a section where the lower income bracket consumers reside may be doing a better job than the large dealer located in a more prosperous, more thickly populated district. Every order taken in the company's showrooms is checked for final disposition. If a distributor does not award the order to the approved dealer nearest to the residence of the consumer an investigation is immediately undertaken. If it develops that the distributor has no representative dealer in that territory, then the company takes the position that this distributor and manufacturer have fallen down on their part of the plan, for it is up to them to develop a representative number of active and progressive retail electrical appliance merchants throughout the territory served by this company.

Complete organization made

The company has set up an organization to help in plan—an organization, we believe, in which the eagerness of youth is balanced by the experience of management.

The territories served by this company are placed under the supervision of three commercial managers, each commercial manager having under his jurisdiction and supervision a definite territory served by business offices and field business representatives. It is the function of the commercial managers, the business office managers and the field business representatives to contact the approved electrical appliance merchants in their territories, to aid them in the sale of appliances and to render the various services that the company has made available for the promotion of the electrical appliance business. The business office manager is responsible to the commercial manager for the development of the electrical appliance merchants located in his territory and for the promotion of such appliance business. It is stipulated that calls be made upon such appliance merchants at least once a month by the commercial manager, and more often by the business office manager and the field business representatives.

A component part of the commercial managers' force is the commercial technical bureau of the sales department, which is a bureau composed of qualified engineering specialists in various lines of electrical applications. Through meetings, over the radio and through correspondence, the services of this bureau are offered to our approved electrical appliance merchants. This bureau is constantly investigating new developments in equipment and utilization of such equipment and the information obtained through such research is transmitted to the dealer at regularly held meetings. The bureau is divided into a number of divisions, as follows:

The lighting division, at the request of the field business representatives, or at the request of any approved dealer, will make a study with a view of submitting a report on the efficiency of the lighting installation with recommendations as to the most modern and satisfactory standards. The first field of endeavor is in the places of business of our approved electrical appliance merchants. Lighting studies have been made of each of such approved electrical appliance merchants' stores, with attendant recommendations, so that such premises will present to customers the latest developments in the lighting field.

The air-conditioning and refrigeration divisions will, upon request, make studies with recommendations and prepare specifications for the installation of air-conditioning and refrigeration equipment. Similar functions are performed by the cooking and heating division and the efficiency studies division.

The bureau also has a statistical division, wherein are filed records on the latest developments and tests of equipment, etc., which records are available to any customer, any contractor, any electrical appliance merchant and to the sales employees of the company.

The domestic appliance promotion bureau in the sales department of the company offers facilities to the dealers which are necessary and helpful. The home service division consists of lecturers and home demonstrators, who are prepared at all times to co-operate with dealers in making demonstrations of electrical devices and give such instructions in the use and application of devices as the dealers' and consumers' wants may require. These company employees also lecture before dealers' groups twice a month, keeping the sales forces of the dealers properly informed as to new developments in the electrical appliance field. Dealers have the privilege of calling upon this group for assistance in order to complete sales of appliances. Inspectors and decorators in the showrooms division of this bureau are in the field advising and helping dealers to make their places of business attractive to prospective customers.

We further make available to the dealers the facilities of the company's showrooms and the facilities of the company's special demonstration booths, where actual demonstrations of laundering electrically, cooking electrically, lighting with proper standards, etc., can be given to any prospective customer in the proper surroundings and atmosphere.

Large showroom attendance

The New York Edison Company supplies the electrical requirements of approximately 3,400,000 persons in the Boroughs of Manhattan and the Bronx and has 725,000 residential meters on its lines. Approximately 70 per cent of our domestic consumers visit our showrooms some time during each month for the purpose of paying their electric bills, signing applications or presenting some question for information or adjustment. We should indeed be poor merchants were we to miss the opportunity of presenting approved, high quality, reasonably priced electric-consuming devices when these consumers visit our showrooms. Sales are made not only by the regular corps of demonstrators but by the application clerks and adjusters as well. Every company employee is taught to take a vital interest in the sale of the company's products—kilowatt-hours. This arrangement has provided a definitely valuable and broad opportunity of interesting these consumers in the purchase of lamps and appliances. The orders for even the smallest of electrical devices and incandescent lamps are productive for experience has proved that they have provided openings through which dealers have been able to sell other and larger appliances and to do constructive appliance service work.

All practicable means are used by the company in developing, through co-operative effort, the sale of electrical devices. Approximately 300 business-getting agents and 100 home service demonstrators, who are especially trained in the business of selling electric service and electric-consuming

devices for the benefit and happiness of their users are in daily contact with our domestic consumers. Surveys of fields of electrical appliance applications are constantly undertaken and progressively completed. Results of these surveys are turned over to the manufacturers, to their distributors and to the dealers. Of a total of 245,000 emergency service calls made within a period of twelve months more than 10 per cent were occasioned by defective home electrical appliances. A series of letters has been devised which are sent to consumers, outlining the causes of interruption of service. Simultaneously, the co-operative retail appliance dealer is notified so that the consumer having defective equipment —live prospective electrical appliance purchasers—can be contacted. This opens a tremendous market for the replacement of sub-standard or worn-out appliances with new, standard appliances which will operate satisfactorily and use kilowatt-hours at the low steps of the rate.

The company initiates special campaigns by the various manufacturer members of the plan, linking its advertising to that of the manufacturer and dealer members of the plan and developing special effort throughout the sales organization for the sale of the device which is being campaigned.

Advertising staffs of the company have been placed at the disposal of the other members of the plan, to aid in the preparation of proper advertising. The result of this aid is demonstrated by the progressive advertising plans undertaken by some of the approved retail appliance merchants.

A series of lectures

The company conducts a series of lectures in the public and private schools, in the churches and in other assemblages, where consumers are acquainted with the advances and newest developments in the domestic electrical appliance field and in the proper use of home electrical appliances for their convenience and happiness. They are shown how to do things electrically. These demonstrations are given annually to about 250,000 individuals, and the company's staff of home service specialists make approximately 2,500 demonstrations annually on major electrical appliances in the consumers' homes. Twice monthly a meeting of approved co-operative retail appliance dealers is held in one of the company's places of assembly for active demonstrations and discussions by experts on the origin, development, operation, cost, etc., of home electrical devices. To these meetings are invited the appliance sales employees of the company, of the dealers and of the department stores. Manufacturers have been co-operative in freely furnishing equipment and experts to assist in demonstrations at these meetings.

Before manufacturers are permitted to display equipment on the company's showroom floors it is required that a report of an approved laboratory test of such equipment be submitted to the company for study and decision. Thereafter, the company's commercial technical group determines the cost of operation of the equipment so that every customer will be assured of equipment which operates within a reasonable cost, and a report is submitted as to whether or not the equipment can be considered as coming within a standard class of qualification.

The manager of the domestic appliance promotion bureau makes an investigation and report as to the ability of the manufacturer to establish sufficient and proper distributing mediums and dealer mediums; as to the ability of the manufacturer to render proper service and repairs; to make proper and prompt delivery, and as to a sufficiently strong financial position to back up such guarantees as may accompany the article and for the financing of proper distribution. The complete sales program of the manufactures is studied with a view to determining the manufacturer's proposed co-operation with his distributor, with the retail appliance dealers and with the company, in advertising and in every phase of the co-operative merchandising plan.

After passing such tests of approval, the customer is guaranteed against the purchase of sub-standard equipment through the company's showrooms or from co-operating retail dealers.

Should space limitations prevent the display of such approved appliances on the various company showroom floors, a rotating schedule is arranged whereby each manufacturer will be given a fair deal in the display of his equipment.

Many of the persons making inquiry regarding electrical appliances on display in the company's showrooms do not purchase at the time of demonstration. In these cases the demonstrator obtains the name and address of the prospective buyer. Such information is recorded on a card, which also indicates other pertinent data, such as equipment demonstrated to the prospective buyer, etc. These leads are given to the business office manager and thereafter distributed to the field business representatives, whose duty it is to contact the prospective buyer and consummate the sale, not only of the electrical appliance demonstrated but of other useful labor-saving home electrical devices. Upon the consummation of the sale the order is routed through the company in identical manner to such orders consummated in the company's showrooms. A careful check and follow-up of all leads and the results obtained by the field business representatives are made under the direct supervision of the business office manager.

Field service offered

Similarly, all co-operating retail electrical appliance dealers are advised that if they fail to consummate the sale of a demonstrated electrical appliance in their places of business, if the name, address, etc., of the prospective buyer is submitted to the company contact will be made by a field business representative in an endeavor to consummate the sale for the dealer submitting the lead.

In this manner a tremendous amount of electrical appliance business is consummated through follow-up calls, even though the sale was not completed on the company's showroom floors or on the premises of the co-operating dealer.

Whenever an electric range is sold a trained and experienced company employee demonstrates the proper use of this equipment to the consumer, in the consumer's home, to make certain that it is properly used and gives satisfactory and efficient service. No time or expense is spared in proper instruction in the use of elertrical appliances, by experts furnished by the company without cost or obligation to the consumer, to the manufacturer or his distributor, or to the retail appliance dealer.

The entire profit from the sale of electrical appliances reverts to the approved electrical appliance merchant —the company asks for none of it, nor accepts any of it.

The results of the plan have definitely proved its merits—merits which may be further increased by modifications or changes which will be developed through experience in the future.

New Fly-Away Rural Lines

Adaptation of Transmission Engineering to Rural Line Construction Results in Innovations that Simplify Construction

By H. R. WILBUR
General Superintendent Metropolitan Edison Company, Easton, Pa.

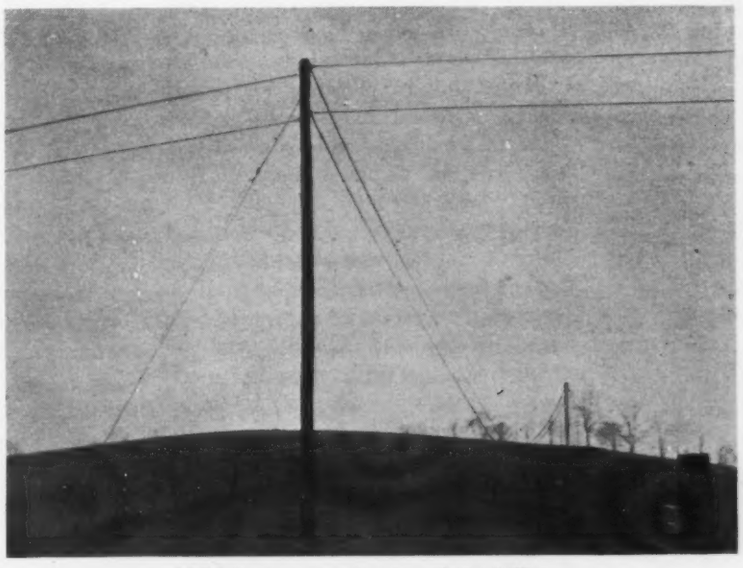
IN OUR area two of the things that have been responsible for comparatively high-cost lines are bad digging conditions and bad tree conditions. The only answer to the bad digging situation is the reduction of the number of poles required per mile to a minimum, thus minimizing the number of holes necessary to dig. The answer to the tree-trimming question is the location of the lines sufficiently far from the trees to avoid interference and thus eliminate the necessity of expensive tree clearance in trimming. Thus there is a very high degree of similarity in this new type of distribution construction and that which has previously been followed in cross-country transmission lines.

The basis of this type of line construction is the use of minimum quantities of low cost material without sacrificing a reasonable factor of safety, together with the selection and use of such types of material as will permit the construction of the lines with minimum labor requirements and with a maximum use of low-cost, comparatively inexperienced labor.

Field inspection and survey

We have found it desirable as the first step preliminary to the actual construction of one of these lines to have a general field inspection made by the man who will be responsible for the layout and engineering of the line, to determine the approximate general location in which the line should be built, keeping in mind three things: First, poles should be spaced as far apart as possible; second, the line should be located far enough back from the highway to avoid as many of the tree conditions as possible and, third, the line so located must still be kept within reasonable proximity to the buildings that are to be served.

The above-mentioned preliminary inspection having been made, the men charged with securing the necessary right-of-way, together with the survey crew which will survey and stake out the line, are advised as to the locations decided on for the work, after which they proceed to survey, stake out and secure the necessary rights-of-way involved. As surveying progresses the line in general is not profiled, as the proper height of poles can be determined from the tables giving sags in feet of various length spans. However, there is occasionally an intervening knoll or other obstruction under the line between poles which may require the determination of its height with reference to the ground line at the base of the adjacent pole in order to insure the specification of the proper height pole in these locations.

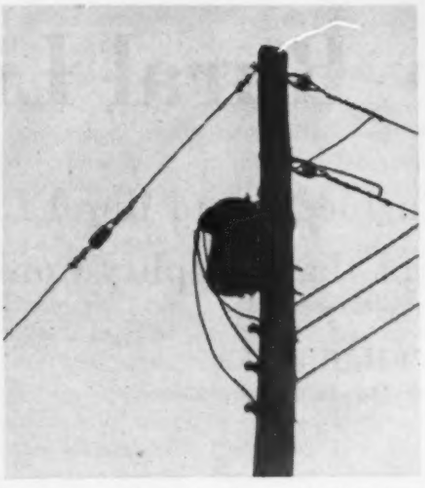


1000-ft. span to the top of the hill

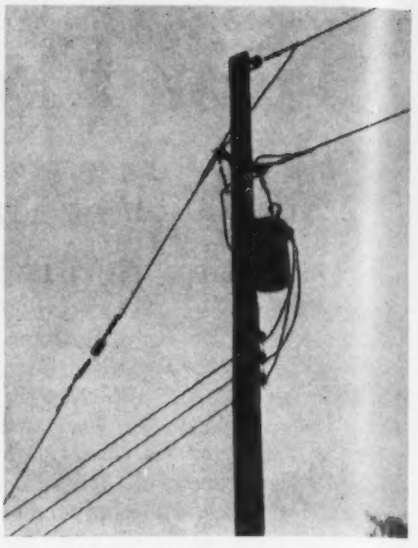
Pole setting starts

At this point we have found it desirable to have this layout carefully checked by some one of good judgment who is thoroughly sold on the long span method of construction in order to see that the absolute minimum number of poles possible has been used and that the line has been so planned as to permit of minimum guying. Once it has been decided that this layout is correct, primary lines, secondary lines and transformer locations are spotted on the working print.

Simultaneous with delivery of the poles, the posthole digger and its crew of two men is started digging the holes. They dig all holes that can be dug readily by machine. Those holes that require drilling and blasting or holes in swampy or marshy areas where the digger cannot operate are skipped and



Left—Typical deadend. Center—Guyed primary deadend and secondary service. Right—Standard primary line



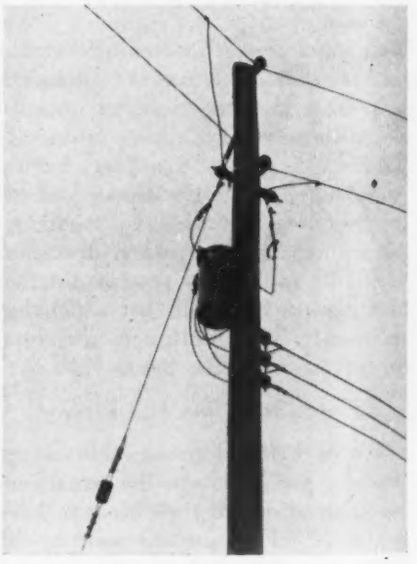
Guyed primary deadend and secondary service

left to be cleaned up later by a hand crew equipped with an air compressor and facilities for blasting. The clean-up crew consists of five laborers without a truck and, besides following up the hole digger, also works ahead of the digger, removing stone rows, etc., if necessary to permit the digger to work. At the same time a crew of two men and a pick-up truck assembles on the pole all equipment, wire supports both primary and secondary, guying attachments, lightning arrester ground wire, and covering molding, etc., prior to the actual setting of the poles in the ground. This truck is also used to make the necessary shifts of the hole clear-up crew from place to place.

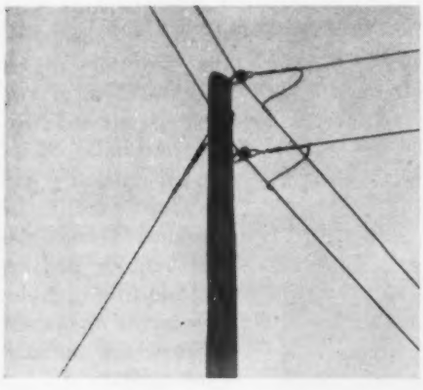
These crews are followed by a pole-setting truck and crew of driver and helper which erects the poles in place. Next a crew consisting of a foreman, truck driver, apprentice lineman who is capable of doing the necessary climbing and four laborers follows and straightens, backfills and tamps the poles, after which this crew completes the guying of the poles. The foreman of this gang is also the foreman of all the previously mentioned gangs and the wire-stringing crew next described.

As soon as the pole-setting crew is far enough ahead to keep out of the way, the wire-stringing crew, which consists of a truck and crew of three apprentice linemen, and who are able to do the necessary climbing in order to place the wire in position and four laborers, follows along and strings the wire in place, pulling it sufficiently tight to get it a reasonable distance above the ground. At one end the line is permanently dead-ended, these dead-ends being made up from the ground in the form of a loop. The wire raised to the pole, the insulator is inserted in the loop, completing the dead-end operation. At the same time the primaries are being strung this crew also strings the necessary secondaries and hangs the transformer on the place provided for it and does all necessary wiring and connections of the transformers, including connections to ground wires and to secondaries, except the actual connecting of the primary transformer leads to the primary lines, this being possible since all this work is done prior to energizing the line.

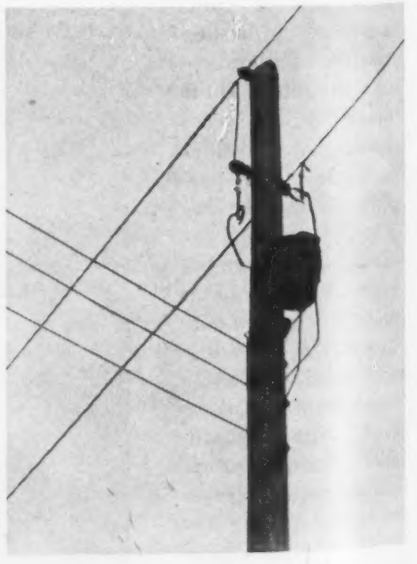
This work having been completed, the next and last step prior to energizing the line is performed by one of the standard line crews, consisting of foreman, driver, five linemen and one groundman, that pulls up and properly sags the line, does whatever tree trimming and clearing is necessary and connects the primaries of the transformer to the line. One such regular line crew can do the sagging and trimming to keep up with two of the above-described general crews.



Pole on turn, transformer, guy, secondaries



Primary tap



Typical three-wire service

Rural Line Costs

Little Possibility of Greater Reduction in Cost Unless the Density Increases—Rural Use Increases Slightly—Need Aggressive Sales Promotion Program

By G. A. CLARK*
Consumers Power Company

TODAY practically all overhead lines extended into rural areas are constructed with small low-strength poles and high-strength conductors, the result being long spans and a small number of poles used per mile of line. The cost per mile of the bare rural primary pole and wire line varies from about $600 to $1,000 per mile, depending almost entirely upon the physical layout and the obstructions encountered in the territory traversed. Further, if a modern design of rural line is used the type of pole or the type of high-strength conductor used will not greatly affect this cost in any one territory. In fact, the effort further to reduce the cost of the physical equipment used in constructing the rural pole and wire line of today is really a consideration of items involving at the most only a few dollars per mile.

Other items of the physical plant necessary in providing rural electric service which greatly affect the investment per customer are transformers, services and meters. While the cost of pole and wire lines have been reduced radically during the past ten years, the cost of transformers, services and meters has changed very little. At the present time it does not appear that further appreciable reductions in the cost of the physical items can be made.

A large portion of the higher density rural areas in Michigan has already been provided with electric service in the constructing of some 9,000 miles of lines by the Detroit Edison and Consumers Power Companies alone. What does this mean in the expense of building rural extensions to the areas of lower customer density? With each customer served from an individual transformer, then the line investment per customer is practically constant for any density and any primary voltage considered. At the $600 figure for line cost and at a density of 7.66 per mile the line cost per customer is, in round figures, $80. When this density drops to 4.97 the line cost per customer increases to about $120, or an increase of 50 per cent. This is an increase in cost which it is impossible to offset by lowering construction costs.

In the actual erecting of rural lines the possibility for reduction of cost lies entirely in the organization of the construction crews and the utilization of mechanical equipment or low cost labor wherever possible. This is especially true where large scale rural line construction is involved. Consumers Power Company is employing crews made up entirely of groundman labor and usually working in conjunction with small digging machines. The ground crew consists of labor in the lower wage scale, directed by a competent foreman. This crew prepares all poles for erection by attaching crossarms, pins and insulators, ground molding, cutouts, arresters, setting anchors and the like. The digging machine, which is usually mounted on a light truck, then digs the hole and erects the poles. The ground crew then follows up the digging machine, straightening poles and backfilling. The line is then ready for the line crew, which is made up of higher priced workmen who complete the job, installing the conductors, transformers, services and meters. While the time and cost of erecting rural lines has been reduced steadily until the present time, it appears that costs may rise again as wage levels and commodity prices rise.

This is a common-sense discussion of the cost of rural lines. It shows the fallacy of using averages. It points out the influence of climatic and geographic conditions as major. It makes suggestions for cost reduction. Above all, however, it shows that the best way to reduce rural costs is to sell energy use to farmers. With fixed costs the dominant factor, the intensive use of energy reduces the unit price of service rapidly.

In addition to the item of fixed charges on the initial rural line cost, there is another major item which affects the economics of extending electric service to rural areas, namely, the operation and maintenance costs of the lines and equipment after installation. Probably the most serious operating hazards are electrical storms and trees. Line outages, blown fuses on transformers and transformer failures as a result of lightning for many years have been the largest single item in the cost of operating rural lines. Since the advent of "interconnection," which is the most effective method of applying lightning arresters to transformers, electrical failures of transformers due to lightning have been substantially reduced both in number and severity. The raising of insulation levels on rural lines by the use of wood braces in place of metal should contribute also to the reduction of line outages due to flashovers during lightning storms and permit some reduction in insulator costs.

Another factor which will result in

*Extract of paper presented before Michigan Electric Light Association, 1936.

Average Rural Line Data in Michigan

	Line No. 1	Line No. 2	Line No. 3	Total	Per Cent Saturation
Length of line—miles	15	21	22.4	58.4	....
Number of customers	68	165	167	400	....
Average number of customers/mile	4.5	7.87	7.45	6.85	....
Average annual kw.-hr./customer	1,070	624	852	795	....
Maximum line demand, kva	36.3	55.2	80.6	.....	....
Average kva./mile at maximum line demand	2.42	2.63	3.6	.....	....
Average demand/customer, kva.	0.534	0.335	0.483	.....	....
Revenue/mile/year, dollars	168.52	205.00	223.00	202.53	....
Revenue/customer/year, dollars.	37.40	26.10	29.90	29.57	....
Connected load, number of lamps, watts/customer	950	690	580	687	....
Ranges	10	24	26	60	15.0

	Line No. 1	Line No. 2	Line No. 3	Total	Per Cent Saturation
Irons	64	135	124	323	80.7
Toasters	34	48	49	131	32.8
Hot plates	10	15	10	35	8.7
Water heaters	2	1	4	7	1.7
Vacuum cleaners	39	48	55	142	35.5
Radios	58	117	103	278	69.5
Refrigerators	15	10	17	42	10.5
Washing machines	42	126	88	256	64.0
Water pumps	32	60	79	171	42.7
Percolators	5	14	12	31	7.7
Ironers	2	.....	.....	2	0.5
Heaters	9	2	4	15	3.8
Milking machines	11	4	2	17	4.3

lower operating costs is the selection of better line locations, usually off the highway. Avoidance of trees will reduce the cost of maintenance trimming and minimize line outages caused by falling limbs. The use of private right-of-way permits lower construction costs and contributes to lower operating and maintenance costs.

Underground rural lines have even been considered as a means of reducing operating and maintenance costs. In the winter of 1934 Consumers Power Company installed an experimental line of this type near Battle Creek. This underground rural line is single phase and operates at 2,400 volts to ground, the cable being of special construction, terminated in disconnecting potheads at each transformer location. Each transformer is installed on a pole, with overhead services to the customers. The cost of this type of construction was relatively high, $7,796, exclusive of the cost of right-of-way, being expended in providing service to 23 customers located along a route 3.25 miles in length, or about $2,400 per mile for seven customers. From the experience gained in this installation we believe that, under average conditions, this cost might be reduced about 12 per cent. An overhead line in the same location, operating at the same voltage, was estimated to cost about 60 per cent of the cost of this underground type of construction. The operating experience with this underground rural line to date has been of too short a duration to attempt to justify the construction of additional mileage.

To summarize the matter of expense of constructing, operating and maintaining rural lines it can be said that:

First—It is still possible to lower unit construction costs a small amount by following designs that are weaker than experience and prudent judgment dictate, but it is not probable that they can be reduced anywhere near enough to offset the increase in cost per customer resulting from lower customer densities that will be encountered.

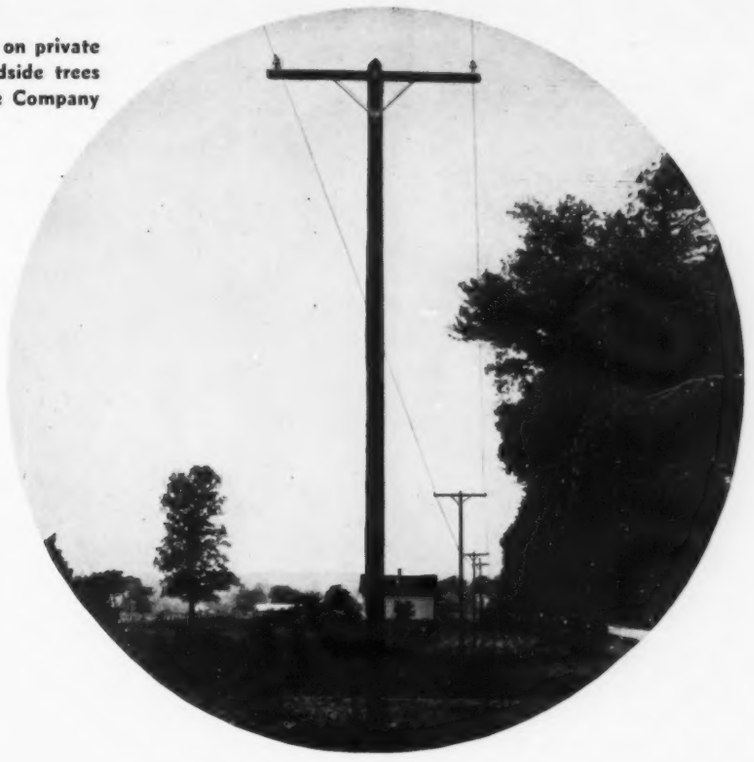
Second — Reductions in operating and maintenance cost can be obtained. How large a reduction can be made depends upon the development of better equipment and the avoiding of potential causes of operating troubles in the layout of rural lines.

Considering the return from the sale of our product to rural customers, much is yet to be done. While I am not familiar with statistics covering other companies, the average annual sale of electric energy in kilowatt-hours per rural customer connected to lines of the Consumers Power Company has shown little increase in the past five years. Compare this with the sale of energy to domestic customers throughout the country for the same period. According to figures compiled by ELECTRICAL WORLD, the sale of energy to all domestic customers has increased approximately 30 per cent during the same period. Rural customers operating farms should be somewhat better potential users than the average city domestic customer, since the average rural customer has more opportunities for the use of electric energy. The indication seems to be that the efforts to sell the uses of electrical service to rural customers have not been strenuous enough and not properly applied.

With suitable, satisfactory equipment available, it becomes our duty to conduct a complete and continuous program designed to build up the rural load. Beginning with the application for service, properly qualified personnel should thoroughly acquaint the rural customer with the equipment available for farm use, its application, its cost of operation, and particularly how the farm customer might make use of it with profit as well as pleasure. Such a rural load-building program must then be followed by aggressive sales campaigns, with suitable inducements to both the customer and sales force. Thus far it appears that suitable inducements have not been given to the sales force to encourage the same effort in rural load building as has been shown in the urban territories.

Conclusion is to sell

During the last ten years we have expended millions of dollars in serving the rural areas, the current year's program is adding millions more, and this will probably continue for several years in the future, with no prospect of reducing rural system investments to the point where present revenues from rural business will cover the annual costs. Realizing these facts, and also that the potential use of electric energy on the farm is greater than in the urban areas, it should be evident then that our big job in rural electrification at the present time is to build up kilowatt-hour sales. The experience in load-building efforts in urban territory shows what can be done. Similar effort devoted to the rural customer should be equally productive. The increase in revenue will show a larger proportionate increase in return on the investment than a similar gain in urban business, and the increased revenue resulting will be just as welcome at the bottom of the balance sheet.



Rural line run on private property to avoid roadside trees
Ohio Public Service Company

By F. R. INNES
Western Editor

Farm Line Building Practices

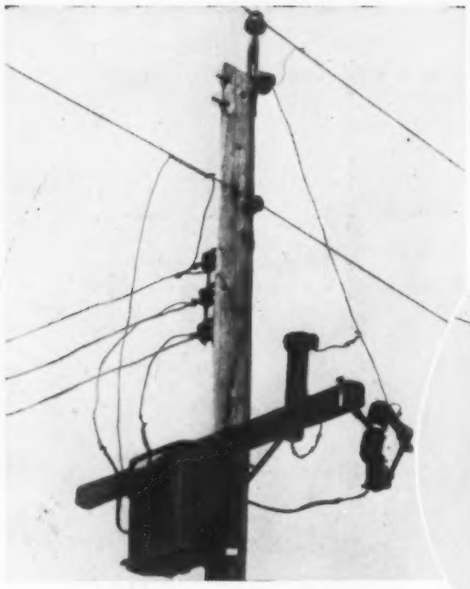
IF THERE is one thing more than another that becomes clearly apparent from a study of various methods of rural line construction it is that major reduction in cost can be achieved only by reduction in the number of line structures with all their included materials and equipments. The savings possible from the use of lower priced clamps, brackets and other parts are insignificant in proportion and it is important to keep in mind that lower prices for these items may mean skimping of quality and strength in them and increased maintenance costs. Given the conductors of high tensile capacity that are now available, the only way to utilize their strength is by hanging them in long spans and this means the use of attachment devices sturdy enough to hold the loads thus imposed on them.

From frequent observation of engineers quibbling over a few cents in the price of a deadend clamp, trying to figure out a way to save a couple of feet of wire in a transformer connection or weighing the cost difference between a pole top and a drive pin, one man of very large experience in line construction finally burst forth with the opinion that in a few years some men he knows are going to regret the way they are building lines today. He refused to be more specific, and when he saw the interest his words aroused appeared rather to wish he had controlled his feelings better. Possibly he should not have sounded off the way he did, but one cannot avoid the thought that history will write down a certain amount of the present effort toward low-cost rural lines as having been, at least, misdirected.

However, no matter what may be said in either derogation or praise of this, that or the other idea in farm line building, it is perfectly plain—appears clearly in the picture story in this issue—that the art is in the well-known state of flux. In somewhat exaggerated recognition of this non-static condition, one engineer replied to the request for material to be used in the article by saying that he could not report on modern practices because the last rural lines built by his company were now more than six months old. Out of this feverish activity in devising and trying new things there will come finally real progress in the means for supplying electricity in the low customer density class of business which is rural service.

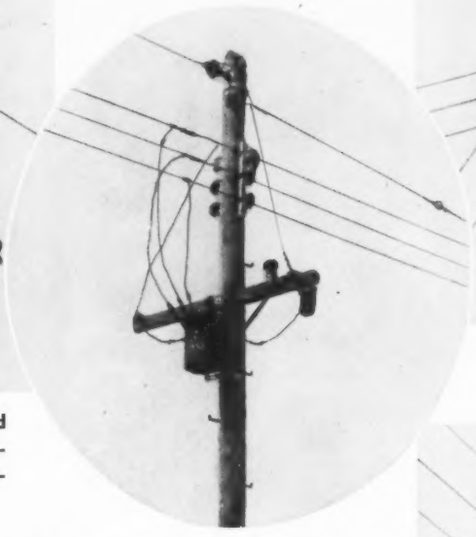
The illustrations and other information presented in this issue are representative of the effort that is being made by all electric utilities to lower the cost of farm lines. The range of cost represented is from $700 to $1,400 per mile including customer connections and metering. It is hard to conceive of reduction much below the lower limit of this range without drawing upon the imagination for some now unknown development that will revolutionize the art of electricity distribution. But the world cannot wait idly for this new thing, whatever it may be, and in the meantime rural service lines must be built with the methods and materials now available.

Worth reporting, but stated only for what it may be worth, is a condition which the editor observed while collecting material for the presentation of this insert. It is that the instances of really low-cost lines, those at the lower end of the above quoted range, were all of utility origin, while the costs of lines being built for co-operatives under R.E.A. specifications were uniformly at the upper end. Profitable rural business lies more in sales than in line costs.

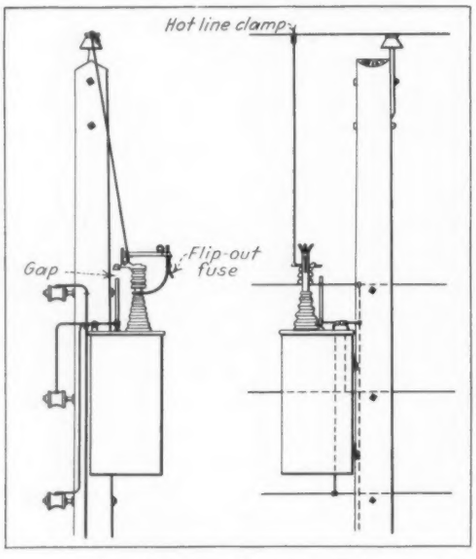


Fuse switch, lightning arrester, standard distribution transformer, 7,200-volt primary. Northern Indiana Public Service Company.

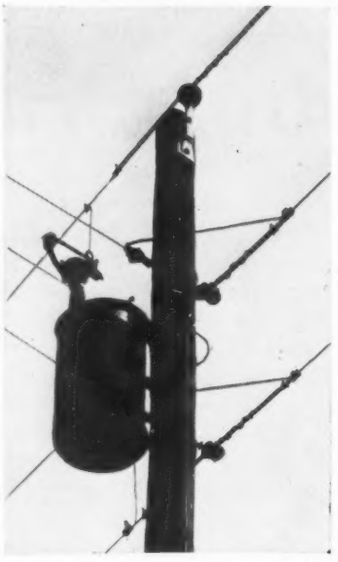
Extension from 2,300-volt urban system using standard distribution transformer, cutout and arrester for service to small farm development. Northern Indiana Public Service Company



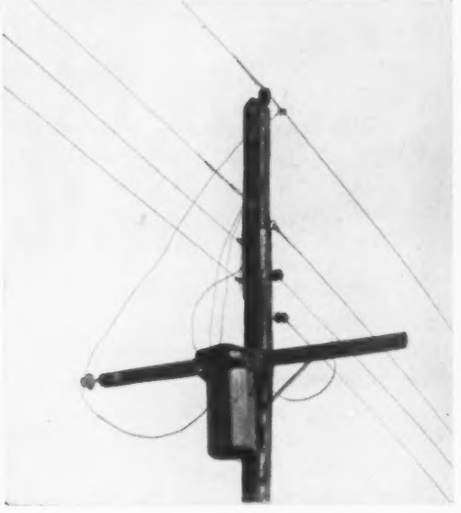
Central Main Power Company uses double-arm construction for transformer installation



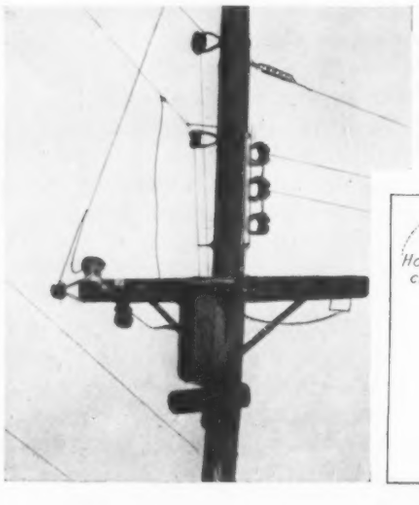
Pole plate transformer mounting as used by T.V.A.



T.V.A. uses a transformer with primary fuse switch mounted on the single bushing

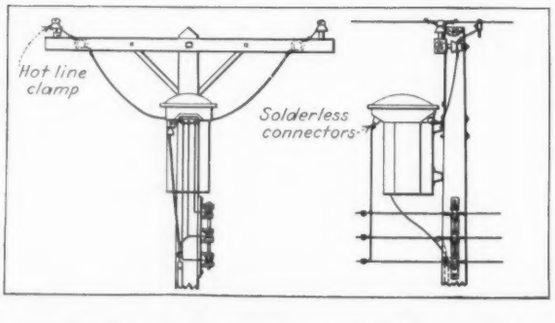


Hot line clamp without arrester or fuse used for 6,900-volt primary connection on this Georgia Power Company CSP transformer installation



Arrester and cutout used in 4,000-volt transformer connection. Georgia Power Company

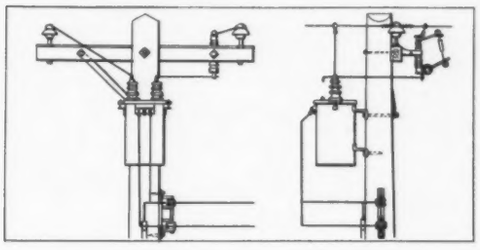
Transformer for almost every rural customer is found necessary by West Texas Utilities Company

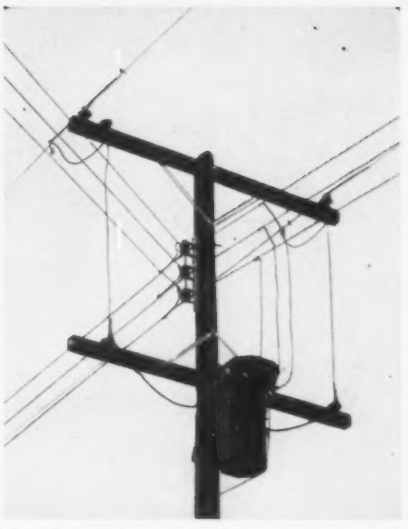


Completely surge-protected transformer as installed by Ohio Public Service Company

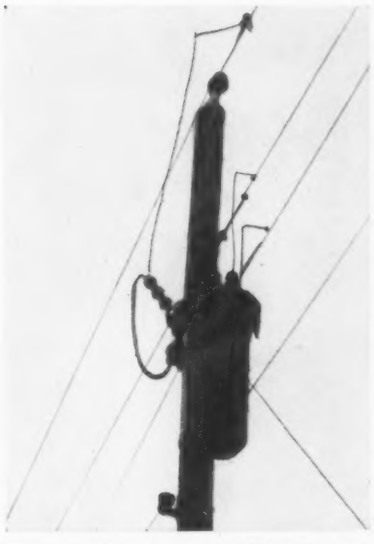
Single bushing transformer on 4,800-volt rural line of Georgia Power Company. Note armor rods on ACSR primary

This transformer connection uses a trip link fuse on one side of the delta primary and a hot line clamp on the other

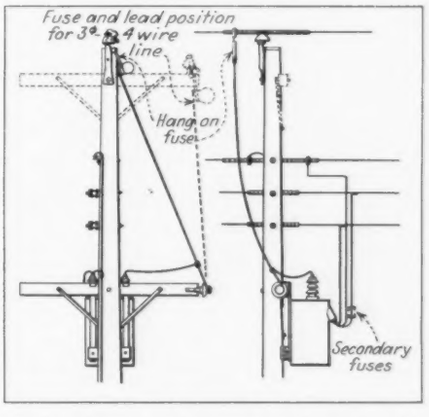




Secondaries above require two arms on the pole for CSP transformer. Ohio Public Service Company



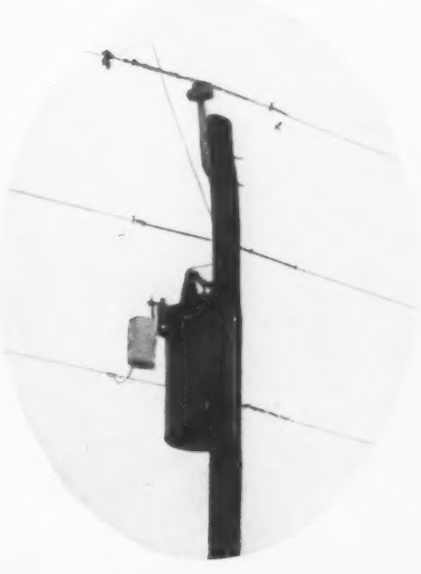
CSP transformer on 7,620-volt line. Louisiana Power & Light Company



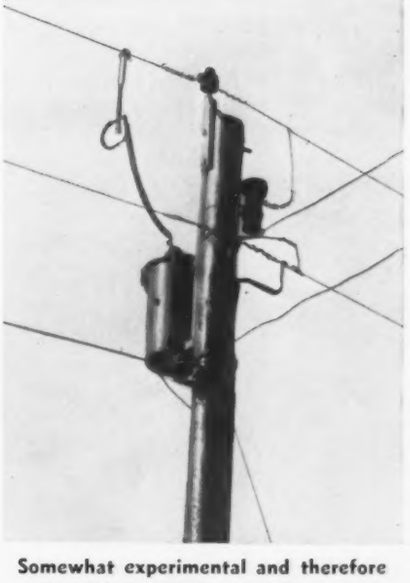
Both primary and secondary fuses in this Georgia Power transformer connection

Only one arm is needed when secondaries are below CSP transformer. Ohio Public Service Company

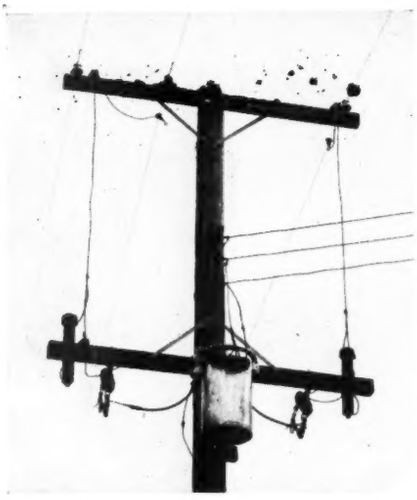
Transformer has internal fusible element and secondary breaker. Louisiana Power & Light Company



Suspension type primary fuse hung from the 7,620-volt phase wire. Louisiana Power & Light Company

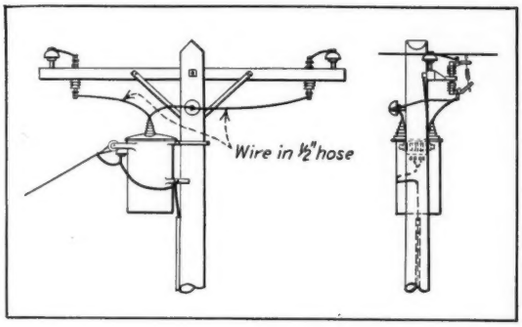


Somewhat experimental and therefore unidentified. Single bushing transformer with fuse hung from 2,400-volt primary conductor. No gap between neutral and ground



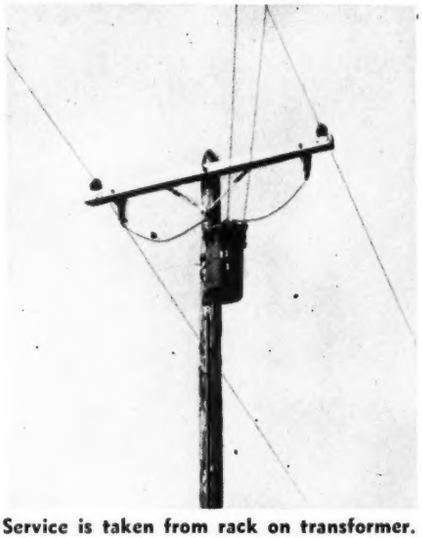
Standard transformer connection for delta line. Ohio Public Service Company

Secondary rack mounted directly on transformer
Pacific Power & Light Company



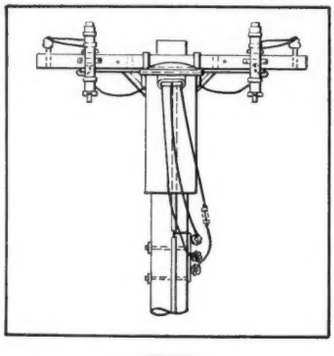
Monroe Electric Company installed transformers in this arrangement for Miami County (Ohio) co-operative

Illinois Northern Utilities Company shows a delta transformer installation using standard equipment in a simplified arrangement



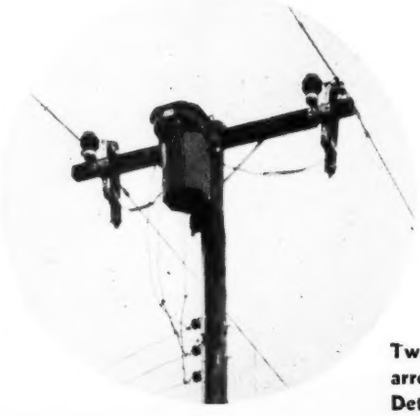
Service is taken from rack on transformer. If two services are installed the second takes off from a buckarm placed below the transformer. Pacific Power & Light

Single bushing transformer on 7,620-volt line of Virginia Electric & Power Company. Cutout hung from phase wire and lightning arrester mounted on transformer case

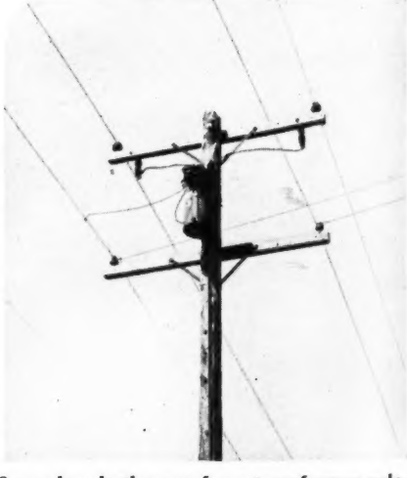


Delta transformer installation
Detroit Edison Company

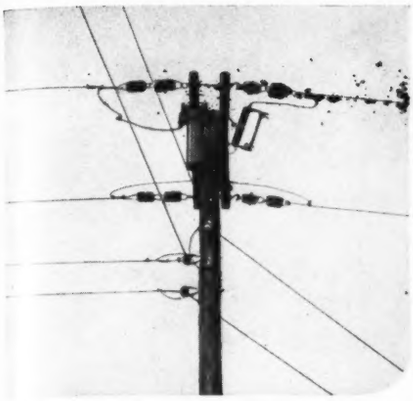
Step type booster on a 2,300-volt grounded neutral lateral with three-shot repeater fuses for sectionalizing. Louisiana Power & Light Company



Two cut-outs and lightning arresters on delta system of Detroit Edison Company

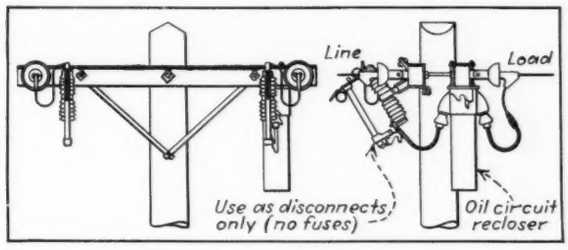


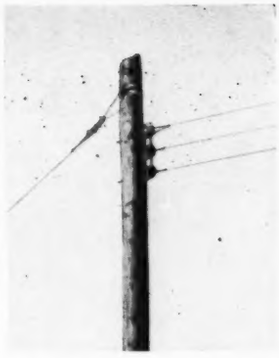
Secondary both ways from transformer pole. Pacific Power & Light Company



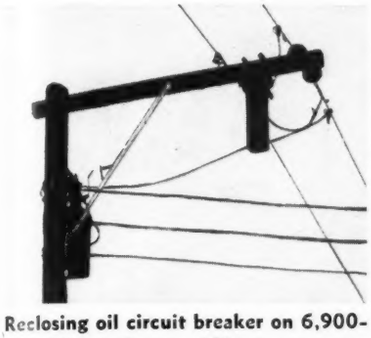
Oil circuit breaker for reclosing 6,900-volt rural line. Georgia Power Company

Trip-out fuse switches used as disconnects in conjunction with reclosing oil circuit breaker

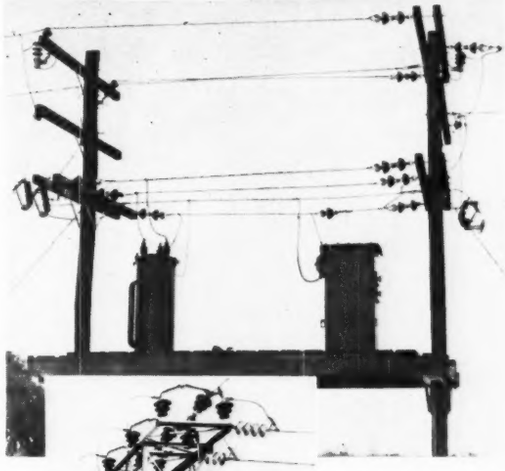




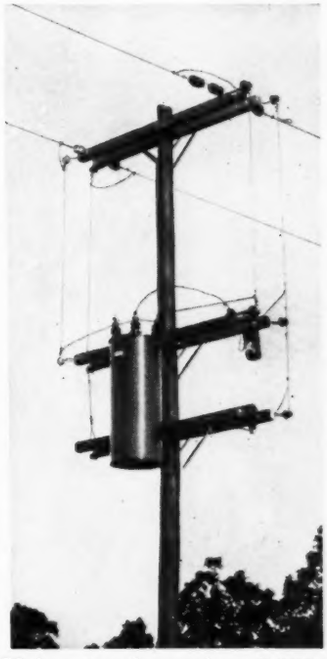
Secondary dead-end. Northern Indiana Public Service Company



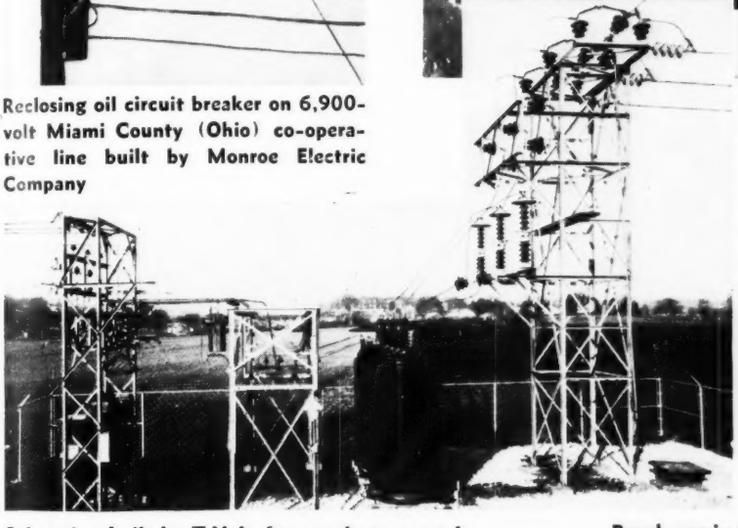
Reclosing oil circuit breaker on 6,900-volt Miami County (Ohio) co-operative line built by Monroe Electric Company



Single-phase substation serving 14.5 miles of 7.6-kv. grounded neutral rural line from a 13-kv. feeder. At right is a step type booster and repeater fuse. Louisiana Power & Light

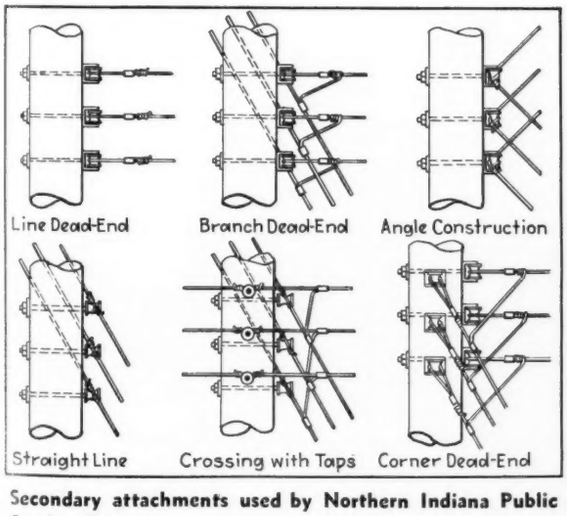


Stepping up with a 50-kva. transformer from 2,300-volt urban system to 6,900 volts for service to a 20-mile rural line. Georgia Power Company

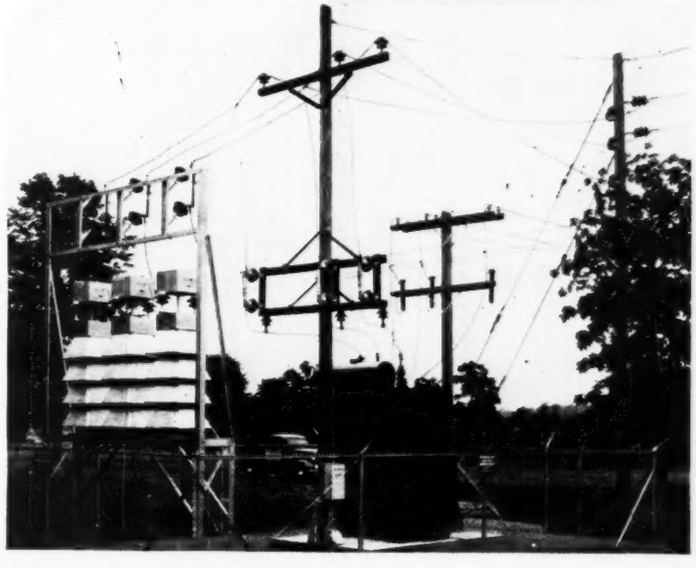


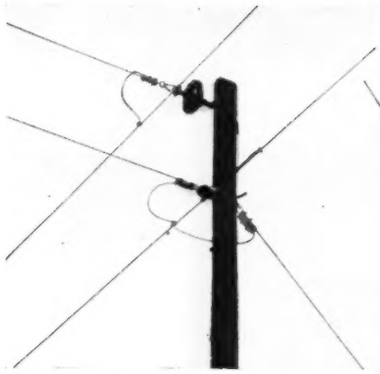
Substation built by T.V.A. for supply to a rural service system

Rural service substation, 23 kv. to 6.9, with 1,000-kva., three-phase transformer and built-in automatic tap changer with four 2½ per cent taps buck and boost. Ohio Public Service Company

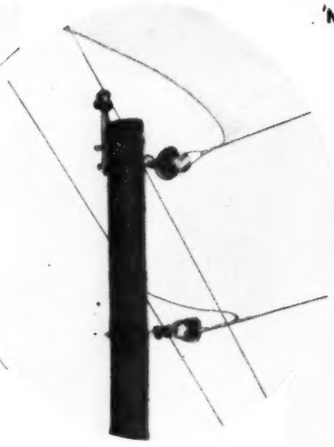


Secondary attachments used by Northern Indiana Public Service Company

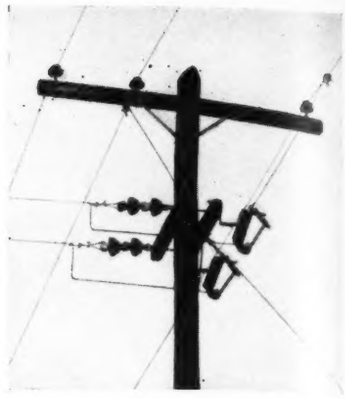




Junction pole on 7,620-volt line of Virginia Electric & Power Company

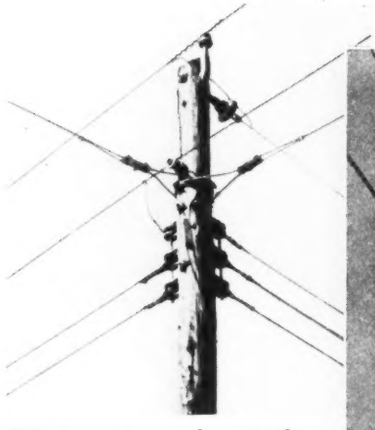


Monroe Electric Company installed this junction pole on the 6,900-volt Miami County (Ohio) co-operative line

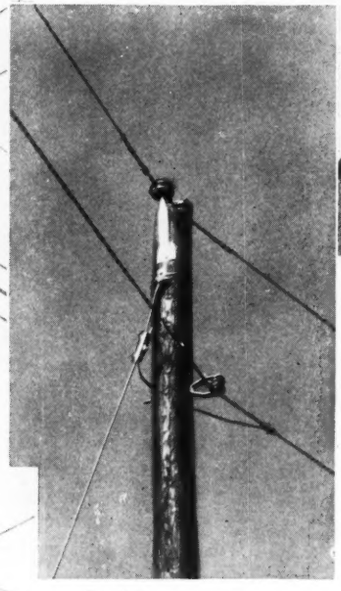


Farm lateral tap off from 13 kva. line. Louisiana Power & Light Company

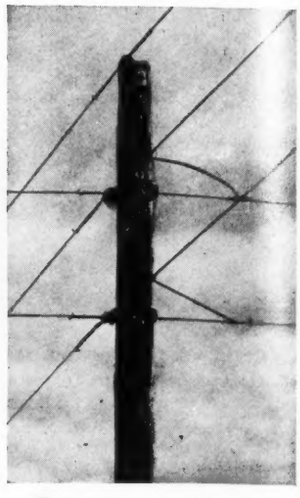
Small poles (25 ft., class 7) and fairly short spans (185 ft.) characterize the low-cost, delta lines built by the Illinois Northern Utilities Company



Primary tap and secondary corner on 2,300-volt line of Northern Indiana Public Service

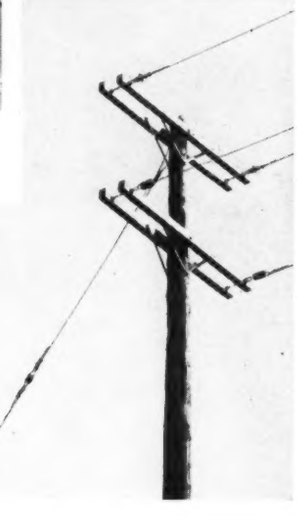


Double-pin angle construction on T.V.A. 6,900-volt line



Two-way secondary tap on a T.V.A. line

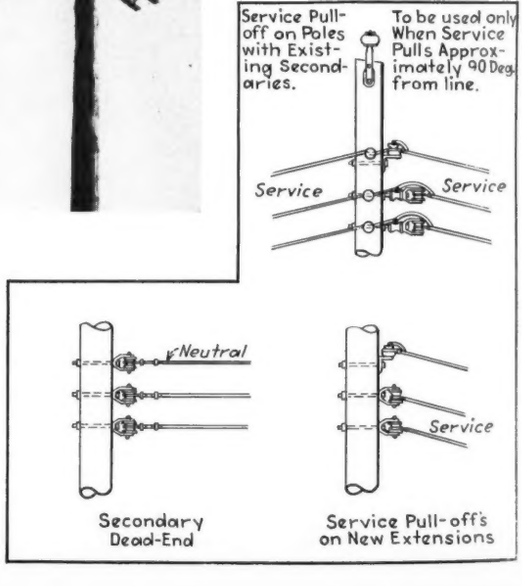
Expulsion cutouts used on 2,300-volt tap-off. Louisiana Power & Light Company

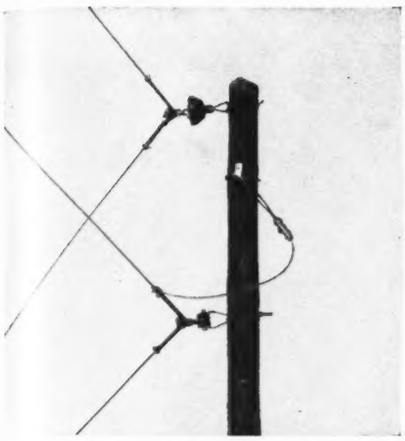


Primary and secondary dead-ends on long-span construction. Pacific Power & Light Company

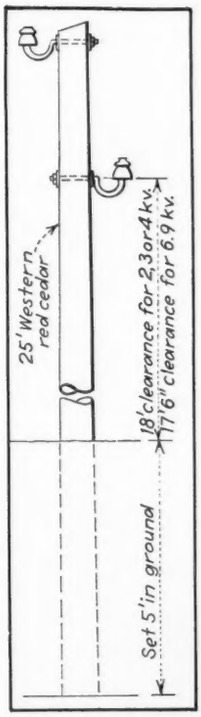
Secondary construction of Georgia Power Company

Secondary dead-end and 4,000-volt primary corner on joint use pole. Georgia Power Company

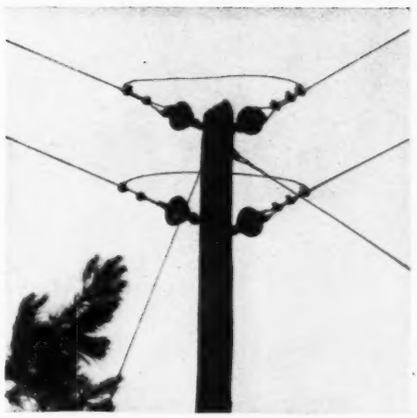




Strain and shackle insulators for a flat angle on T.V.A. 6,900-volt line



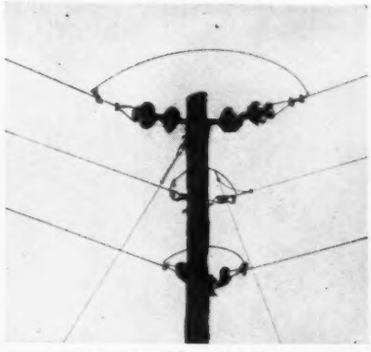
Grounds at every pole on this new 2,400-volt line in Ohio



Corner on 2,300-volt delta line Louisiana Power & Light Company

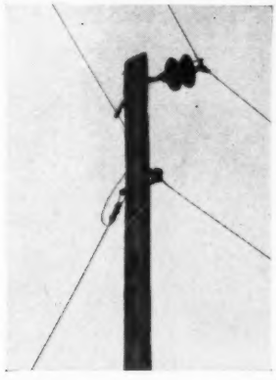
Standard insulators on hook pins used for tangent construction by Illinois Northern Utilities Company

Typical low-cost line of Puget Sound Power & Light Co. If load growth requires, this 6,900-volt, single-phase line can be changed to 11,000-volt star, three phas-

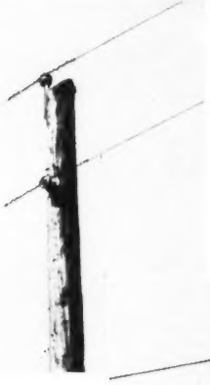


Construction for 60 to 90 deg. corners on 7,620-volt line. Louisiana Power & Light Company

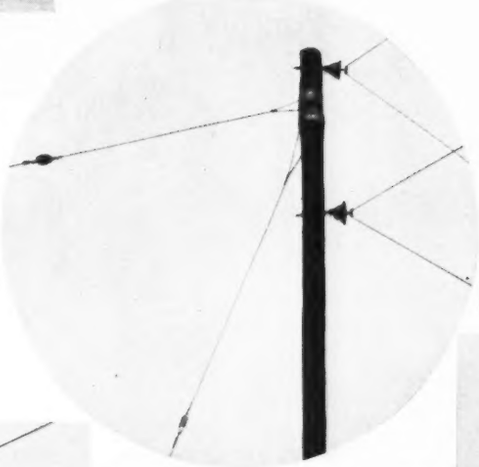
Square corner on Detroit Edison line



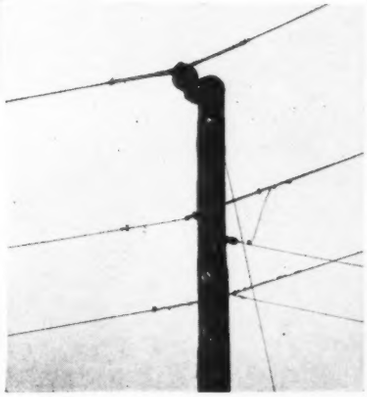
Angle construction for 7,620-volt line of Virginia Electric & Power



Neutral carried on a knob in this 2,300-volt line of Northern Indiana Public Service Company



Simplified construction in Ohio. Spans average 275-300 ft. Voltage is 2,400

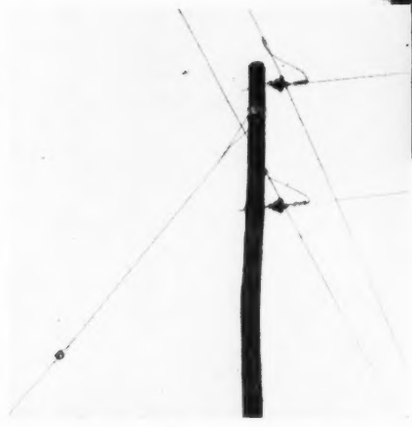


Construction for 15 to 60 deg. angles on 7,620-volt line. Louisiana Power & Light Company.

Semi-strain corner uses shackles for both conductors. Central Maine Power Company

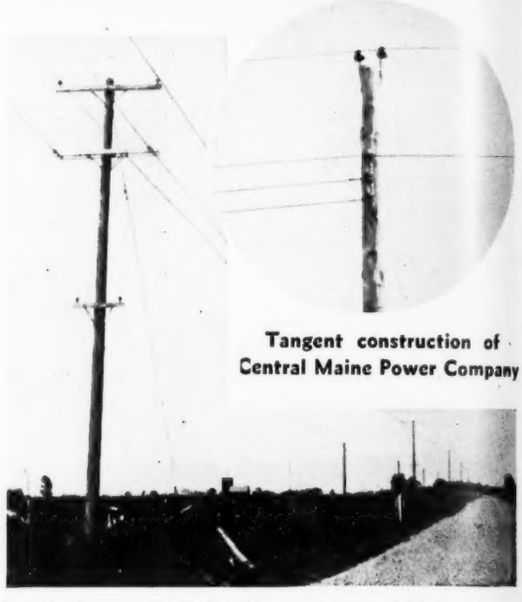
For long secondary spans several companies have tried out spacers like this, but mostly it is better to shorten the spans on account of pole loadings

Typical new rural line construction of Ohio Public Service Company



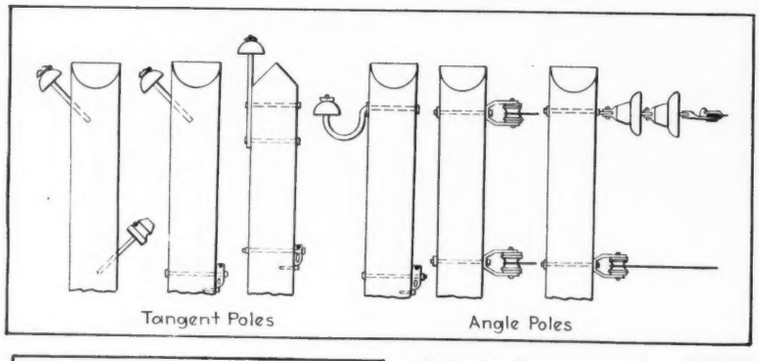
Junction pole on delta system The Detroit Edison Company

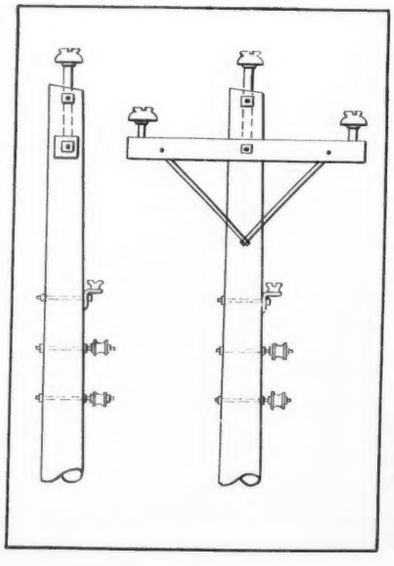
Hook bracket for phase wire on this 7,620-volt line of Virginia Electric & Power Company



Tangent construction of Central Maine Power Company

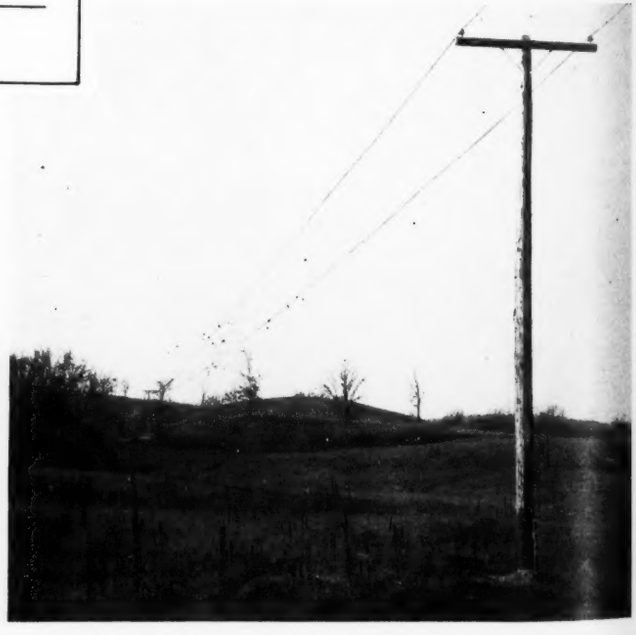
Pacific Power & Light Company uses 500-ft. spans





Methods of tangent and angle pole construction used on 2,300 to 7,600-volt circuits by Virginia Electric & Power Company

Long span over gully Detroit Edison Company



Single-phase line readily changed to three phase in this design of Georgia Power Company

Wide Market Opened by Low-Cost Load Center

Joint Development Aimed at New Home, Wired Farm and Electrified Kitchen Offers Use Continuity at Lessened Servicing Cost

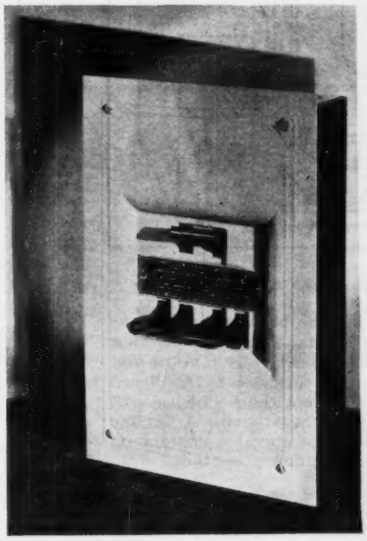
By J. G. JACKSON* . . . O. S. JENNINGS†

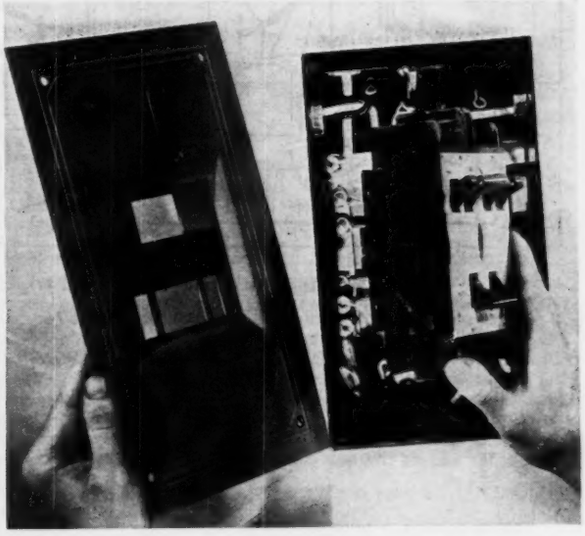
Before 1936 is rung out 13,000 farms will have been added to electric lines, 130,000 new homes will have been built and 300,000 new ranges will have instituted electric kitchens. Thus, even neglecting the homes that are steadily rewiring, prospects for some 500,000 new load centers will have been created. To grasp this market, a new low-cost load-center control is offered.

WITH direct benefits for utilities, architects, electrical contractors, builders and home owners, a compact, low-cost, automatic multi-circuit load center for low-voltage distribution has been developed following preliminary discussions with a number of utilities. Automatic circuit breakers, instead of conventional switch and fuse combinations, for the protection of distribution circuits have already been widely adopted, but because of their cost the market has been limited. The present multi-breaker design will sell for approximately one-third the price of previous load centers using individual circuit breakers and approximately the same as switch and fuse combinations, and is particularly applicable for residences, small stores and farm buildings for supplying range, water heater, lighting and appliance branch circuits.

The unit is for a.c. applications up to six circuits. Branch circuit capacities will be 15, 20, 25, 35, and eventually 50 amp. Breakers are single pole, with mechanical connection of handles for two-pole operation when so desired. The great majority of residential applications can be installed to meet the provisions of Section 405, Par. "a," Exception 2, National Electrical Code, which eliminates the requirement for separate automatic protective device for the

*Director Engineering, Square D Company, Detroit, Mich.
†Engineering Division, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.





Compact multi-breaker device with 70-amp. mains provides up to six single-pole circuits that may be mechanically connected in pairs when desired. The multi-breaker units are mounted in a steel box on a "swing-out" bracket hinged to the box at one side and clamped by screws to the other. By loosening the screws it can be swung out, carrying the breakers with it. This leaves the box free for pulling in the wires and for preparing them for attachment to the breaker terminals. Plenty of space is left beneath the breakers to accommodate the wires. The neutral plate is located under the swingout bracket, but with the wire terminals in the clear.

New load center has swing-out feature

Electrical features

Electrically, the unit has all the features which have been found essential—time element, high-grade silver alloy contacts, solderless connectors, low heating, resulting from all-welded internal connections, and the simplicity which insures permanent and reliable performance. The rupturing ability at 125 volts a.c. is 5,000 amp., as required for all branch circuit breakers. When installed in a residence the operation is similar to that of a snap switch and is readily understood and operated by any one. The time element is long enough to allow household motors to start without tripping the circuit breakers. The common central contact for all poles in the unit and the simplified connections greatly reduce the losses and heating. These characteristics give the multi-breaker the lowest watts loss and consequent heating of any comparable form of circuit protective equipment.

Since each breaker pole trips independently, no circuit is opened unless it is in trouble. This allows service to be maintained except on the affected branch. With a three-wire branch using a two-pole combination only the side which needs to be opened is tripped automatically; however, manual operation opens both sides simultaneously. Cooling of the bimetal is rapid enough so that except for a severe short circuit the breaker can be reset as soon as a person can reach it.

mains where approved circuit breakers, grouped in a cabinet, are used in the branch circuits. This materially assists in securing a quality-low-cost installation.

Avoids expense of fuse replacements

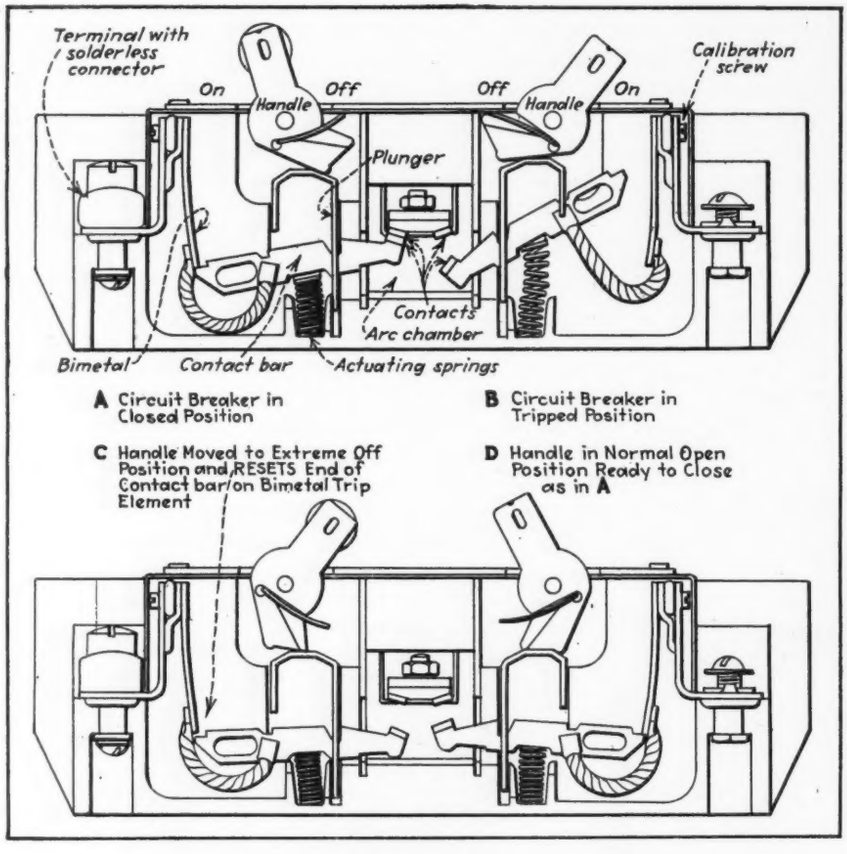
According to information received from several power companies, fuse replacement cost per year runs into thousands of dollars. One such utility spends 15.6 cents per year for every residential customer on its lines. Another spends in excess of 25 cents a customer. Still another more than 50 cents. The new multi-breaker load center gives them an opportunity to reduce this expense gradually. In addition to this easily seen benefit, the utilities like the load center because it avoids loss of many kilowatt-hours of consumption due to outages and retains valuable good will which might be lost if there were a long delay in waiting for the service man, and they also appreciate the tamper-proof features of this multi-breaker protection.

The home owner, too, likes an automatic device of this kind. Because of its attractive appearance, the multi-breaker load center can be placed in the kitchen or hall, where it is readily accessible. There is nothing to renew or replace when the circuit is automatically opened. To reclose, the handle is simply moved from the clearly indicated tripped position to the extreme "Off" and then to the "On" position.

Typical arrangements

The multi-breaker load center can be supplied with up to 70 amp. solid mains and branch circuits ranging from 15 to 35 amp. Most of these circuits will require single-pole breakers, but two-pole breakers are available for three-wire sub-feeds, such as for a range or water heater circuit or a branch to other sub-feed points. The required multi-breaker combination is housed in a steel box for flush or surface mounting and is provided with a terminal plate for ground and main and branch neutral connections. Breaker handles are protected by a recessed cover.

A typical arrangement may have 70-amp. solid mains, a three-wire, 35-amp. range circuit, four 15-amp. lighting circuits and a three-wire, 20-amp. heavy-



Combines switch and overload trip functions

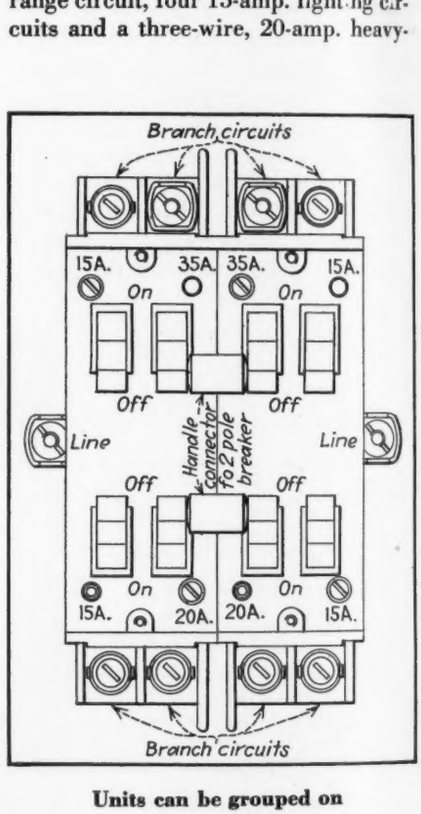
A terminal carrying a bimetallic thermal element for tripping the breaker and a contact bar compose the active elements for automatic operation. A handle and connecting link serve to operate the contact bar manually. The contact bar is centrally pivoted and is actuated by a heavy compression spring which provides contact pressure in the closed position and serves to rock the bar to "On" and "Off" and tripped positions when moved by the handle, or released by the bimetal to which the bar is directly latched. A flexible lead makes electrical connection from bimetal to contact bar. The movable contact on the other end of the bar completes the circuit to the common stationary contact.

How it works

The handles are pivoted in the top of the molded base and move to open and close the breaker as in any toggle switch. To reset the breaker when tripped, it is only necessary to move the handle to the extreme off position, which causes the contact bar to relatch to the bimetal.

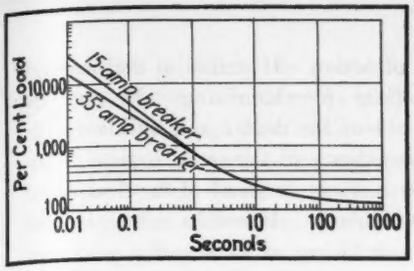
During automatic operation the bimetal heats up from overload and releases the engaging end of the contact bar, thus permitting the contacts to separate within the arc-suppressing chamber and the handle to move to the "tripped" indicating position.

After calibration, in manufacture, a steel cover is riveted to the molded housing and completes and seals the inclosure, thus rendering the multi-breaker tamper-proof. For three-wire applications two multi-pole units are placed side by side, and when a double-pole breaker arrangement is desired the handles of two adjacent breaker poles are connected together by a spacing bar.

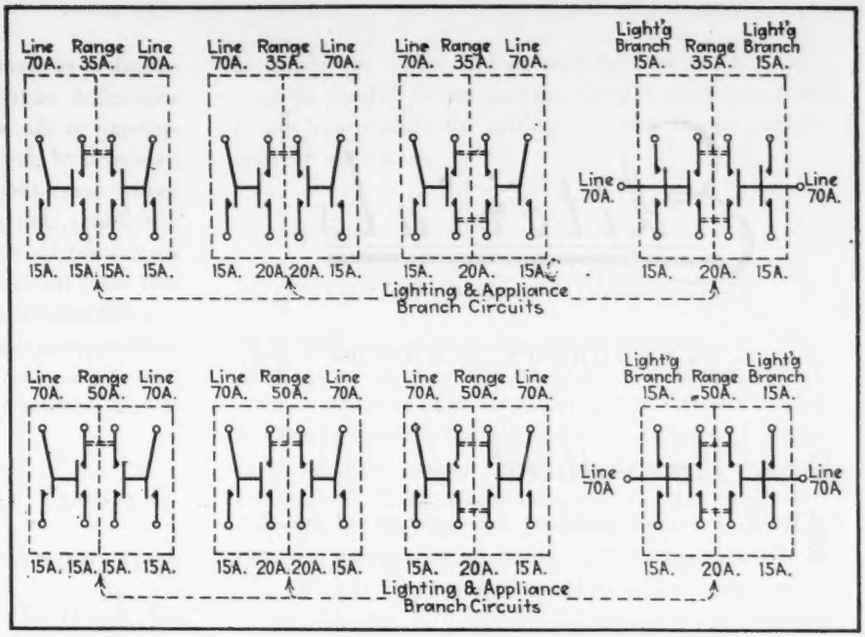


Units can be grouped on single housing

Multi-breaker poles of the same polarity, up to four circuits, are grouped in a unit housing of molded insulating material. A centrally mounted stationary contact plate is common to all individual poles. This contact plate also provides for the solid mains connection to either an end or side located terminal. Where required, a pair of breaker poles may be used for the mains and the solid connection omitted or employed as a mains extension tap.



Average trip-time curve for bimetal overload protection


Line 70A. Range 35A. Line 70A.
15A. 15A. 15A. 15A.
15A. 20A. 20A. 15A.
15A. 20A. 15A.
Light'g Branch 15A. Range 35A. Light'g Branch 15A.
Line 70A.
Line 70A.
15A. 20A. 15A.
Lighting & Appliance Branch Circuits
Line 70A. Range 50A. Line 70A.
15A. 15A. 15A. 15A.
15A. 20A. 20A. 15A.
15A. 20A. 15A.
Light'g Branch 15A. Range 50A. Light'g Branch 15A.
Line 70A
Line 70A
15A. 20A. 15A.
Lighting & Appliance Branch Circuits

Many wiring schemes possible

duty appliance circuit. All this is assembled in a box 11x6½x3½ in. deep with back wiring space and knockouts to suit any requirements. The flush type, which is often located in the kitchen, is finished in a neutral gray enamel which harmonizes with many color schemes. The surface type is finished in black enamel.

Many advantages

The design offers many advantages. Its simplicity makes for uniform action and freedom from trouble. There are only two main moving elements actuated by the handle, the connecting link and the contact bar. Absence of bearings and metal-to-metal sliding parts eliminates the possibility of corrosion and sticking. With the exception of the connecting link, all mechanism parts are of bronze or other non-corrosive metal. This insures long life and reliability even after standing for long periods of time. No bolted or riveted, hinged or pivoted sliding connections are used. The multi-breaker unit has only one moving part per pole required to move in response to the flexing of the bimetal to open the circuit automatically. It is, to a greater extent than in previous devices, tamper-proof, rugged and dependable.

The multi-breaker load center has been designed to keep pace with electrical development for the home. The unit itself is an interesting, simple and effective device developed to meet requirements effectively for circuit protection and control in a residence at low cost. Simplified design has resulted in a compact, inexpensive, rugged device, incorporating all essential features that have been found desirable for circuit protection and safe operation. It is low in cost, like the old-time fusible devices, yet meets the needs of the present day. It provides a center for distributing the current manual control of all circuits, automatic overload protection for each circuit, time element to avoid unnecessary interruption from momentary overloads and perfect safety.

Eight Years of Rural Service

By F. M. MASON*

The Detroit Edison Company

THE township of Macomb, in Michigan, has had electric service available to 100 per cent of the farms for eight years. There are 340 farms requiring a distribution system of 57 miles, or six farms per mile.

Average monthly consumption per farm is as follows: January-February, 680 kw.-hr.; March-April, 540 kw.-hr.; May-June, 550 kw.-hr.; July-August, 620 kw.-hr.; September-October, 610 kw.-hr.; November-December, 703 kw.-hr. It is interesting to note the effect of ranges and refrigerators in keeping up the load in summer.

Average annual consumption per customer over a period of eight years and the average monthly electric bill per customer are as follows:

	Kw.-Hr.			Kw.-Hr.	
1928.....	420	$1.90	1932.....	705	2.30
1929.....	510	2.10	1933.....	630	2.20
1930.....	780	2.60	1934.....	700	2.30
1931.....	805	2.50	1935.....	720	2.50

Total connected load is about 1,162 kw., or an average of 3.5 kw. for each of 325 farms. The demand on five well-equipped farms having an average connected load of 11.9 kw. is 3.4 kw. Out of 325 active farms only five can be classified as well equipped electrically.

A summary of electrical equipment on one of the five farms in order of load-building value has been determined from a three-year record of consumption:

	Kw.-Hr. Use		Kw.-Hr. Use
Cooking.....	1,683	Poultry house lighting....	384
Water heating.....	888	Milking.....	269
Lighting and miscellaneous appliances—radio, iron, griddle, cleaner, washer, clock.....	749	Brooding.....	237
		Barn ventilation.....	212
		Water pumping.....	204
		Barn lighting.....	101
Feed grinding.....	635	Silo filling.....	39
Milk cooling.....	626	Hay hoisting.....	13
Refrigerator (house).....	498	Grain elevating.....	11

*Abstract of paper presented at Michigan Electric Light Association, 1936. Data taken from charts.

Editorials

L. W. W. MORROW • EDITOR

Busy Times Ahead

THIS is an extraordinary business period for the electrical industry. There is no summer slump. Utility energy sales are 16 per cent over the corresponding period in 1935 and 22 per cent over the 1929 value and are still going up. Manufacturers report sales above their bogies with business still on the up-grade.

Where is the business coming from? The answer is everywhere. All markets are active for electrical products and electric service. From turbo-generators to appliances and wiring, products are in demand in all sections. Yet most of the present business is due to improved economic conditions, the forces of competition that make industry electrify and popular favor for things electrical. It is necessity buying of equipment and it is necessity use of energy.

Is this a temporary condition? First-hand observations and reports in all sections indicate that this upturn in business is just getting well started. Expectations are for a steadily increased volume of business in the coming months. There is no tangible obstacle to overcome. With this outlook it behooves utilities and electrical manufacturers to stir themselves to supply the coming demand. It should be anticipated by plans now put into action. Busy times are ahead for the electrical industry.

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That New York Merchandising Plan

WE HAVE long contended that no generalization should be made as to whether a utility does or does not sell appliances. That is not the point. Both policies are good. Both policies get results. *If* they are carried out intelligently. There can be no argument, however, on the necessity for a utility to put its best talent, man-power and money back of the merchandising efforts exerted in its territory.

The New York Merchandising Plan explained by Mr. Jeffe in this issue is a case in point. Here is a complete program of action. It strikes at the heart of successful metropolitan merchandising. It puts its strength at the service of the dealer and builds up the number and the competency of the retail outlets. Perhaps it leans too far to carry the load of the dealer and distributor, but we doubt it. If results are to be had there must be a frank facing of facts and a plan that will meet the situation.

Whether a utility merchandises or not, there is a working program for every executive to study in this New York plan. It is an example of what can and should be done in every service territory.

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Interconnection—A Necessity in Extraordinary Emergencies

THE recent unprecedented floods are over and most of the damage caused by them has been repaired. But the final chapter in the history of these floods will not be written for a long time. As a matter of course, sequences of events will be reconstructed, faults of judgment—in omission and in commission—will be brought to light, apparatus and design weaknesses will be revealed. And with the bringing to light of all of these, steps will be taken to strengthen the weaknesses disclosed. That will be one of the items on the credit side of the ledger.

In this certain-to-follow self-analysis on the part of the operating heads of many utilities, it is hoped that the matter of interconnection will not fail to be thoroughly reanalyzed and reconsidered. For although it is true that the utilities of the country have come out of this emergency heroically and that interconnection was of enormous help in maintaining and, later, in restoring service, the fact remains that in a number of cases serious gaps in interconnection, or bottleneck limitations in existing interconnections, were disclosed by the flood-created emergency. The net result was a delay in re-establishing full service which could have been avoided if the primary power available in the territory had not been stopped from reaching the needed spot due to the total lack of, or inadequate, interconnection facilities. It would be a definite waste of precious experience if some of these gaps in interconnection are not restudied and closed, wherever at all justifiable.

All of this we have pointed out before. But the subject can stand restatement. Besides, it is frequently admittedly difficult to justify interconnection on a strictly economic basis. For, examined coldly, interconnection can in the general case be justified only by (1) the savings in standby or spinning reserve, (2) the operating savings due to closed co-ordination of operation, better use of facilities, etc., and (3) the provisions for handling of extraordinary and unforeseen emer-

gency. The problem then generally resolves itself to find enough return under (1) and (2) to have (3) available as a by-product. Considering, however, the importance of protection for extraordinary emergency, can there be any doubt as to the necessity of exerting maximum effort to find returns under (1) and (2)? We think not. For if the recent floods have demonstrated one thing, it is that the Biblical observation, "It is not good for man to stand alone," applies with equal force in the case of electric power systems—it is not good for utility systems to stand alone.

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Just to Prove It Can Be Done

LOAD BUILDING is not a mere matter of selling. Primarily it is concerned with making people want to buy. The distinction is commercially important, because this is not something that you do to people, but something they must want to do for themselves. A good example recently came out of Queens.

The 4,500 employees of the New York & Queens Electric Light & Power Company have known about electric cooking for a long time. A home economics department has been active there for years, a range rate was available, and special inducements encouraged employees to buy—just as in other progressive cities. And then one day there came a campaign to employees, with all the preparation, build-up and enthusiastic competition that a big organization can pile on when it tears loose to do something. At the end of a month 2,076 employees had adopted electric cooking in their homes.

Say what you will, this is a big achievement. For there is more than the load involved. The important thing is this quick proof that it can be done—plus 2,000 more boosters at work in Long Island homes, spreading the influence of their good example. Among them were 859 members of the distribution personnel and 83 per cent of the auditor's department. And while they were about it, they also bought some 600 more electric refrigerators.

It is an amazing record that should start a lot of thoughtful figuring by the executives of many other power companies. For all these families did not adopt electric cooking all of a sudden just because they were employees of the utility. They had been there right along and many a salesman had tried and failed to sell them. This time, however, they wanted to buy. And they wanted to buy not as employees, but because they were normal, impressionable people, like the rest of us. So they responded to an emotional appeal and, if it had come before, many of them would probably have been cooking electrically for years.

Load building drags in many cities because executives measure possibilities in dollars and man-power. They forget that it is ideas and enthusiasm, not mere money, that builds markets among consumers as well as employees. The vital question is, how much do you want the load? Given the zeal, there is almost no limit to the opportunity for selling this year in the present state of saturation.

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Improving Station Take-offs

MORE importance attaches to facilities for "shipping" energy out of generating plants than is always apparent after scrutinizing such layouts. Since the floods receded, tours around the outsides of station buildings have become deservedly popular in engineering circles. Many things have come to light which bear upon future reliability of service, and among these the arrangements for present and future take-off of plant output attract the technical eye. It is not so much a matter of building switchyard structures that will tower above high water mark as of providing adequate facilities to meet normal demands for reliable operation, reasonable protection against the unleashed forces of nature and economical expansion of equipment and material layouts under future conditions.

While makeshift locations of transformer banks, circuit breakers, lightning arresters and outgoing overhead spans "work" well enough, critical study of plant surroundings points to the lasting value of providing for symmetrical expansion of these facilities. Uneven development of outgoing cabling, hit-or-miss location of bus taps and disconnecting switches, "bunching" of feeders without proper regard for protection against heavy short circuits, and the use of unduly thin members in outdoor wall racks spell excess reconstruction costs when these are forced by load shifts, growth of output and interconnections. Rebuilding outdoor structures runs into money if drastic modernization is demanded, but such outlays may be warranted in the interest of more efficient service if plants have been allowed Topsy-like growth without the station walls.

This means applying unit principles in the station yard as well as inside the plant. It means checking the length of circuit spans next to the station with respect to weather potentialities, and taking account of the adequacy of outgoing conductors in regard to loading, both electrical and mechanical. Where conductors have been "doubled up" on outgoing spans to provide increased circular millage, sometimes using extra circuits to overcome "bottlenecks" in take-off conductivity, the possibilities of parallel construction underground or overhead deserve analysis. Many other examples of power plant outdoor housekeeping may well be investigated from layout, operating and expansion standpoints in the coming months, and take-offs provide an excellent place to begin such good work.

This Business of Propaganda

CONSIDER President Roosevelt's remarks after his recent visit to Passamaquoddy. Particularly that the project must be completed, and why. America's demand for electric power, said the President, is increasing at a rate of from 10 to 15 per cent a year. Loss in transmission over distances, meanwhile, is constantly being curtailed. So Quoddy is bound to be needed, hence must be finished. Q.E.D.

It's as simple as that in the President's mind, all the opinions of experts against this particular project being waved airily aside. Which is terribly important because of the white light it throws on Mr. Roosevelt's mental processes. It reveals the highly educated theorist, whose pure logic has never met the disappointment of actual business experience.

For the terrible part of this is that all of the President's premises are absolutely correct. Demand for electric energy is increasing at just about that rate—is more likely to exceed it than to fall below his expectations. It is also true that the loss in transmission over long-distance power lines is constantly being cut down.

So what?

Consider for a moment that a group of investors had been calculating on whether they would put their money into the development of Quoddy. Some of them, if not all, would be men who had listened to high-pressure salesmen for sure get-rich-quick schemes before. They would listen to the points on which Mr. Roosevelt builds his case, then they would ask questions. For instance:

Would it be possible for some competitor to put up a plant that would generate power more cheaply than Quoddy in the same vicinity?

Would it be possible for some competitor to put up a plant which would generate power either more cheaply or just as cheaply a little closer to possible markets, thus cutting down initial cost of the power line?

Is the improvement in economies in steam-produced electricity apt to enable some competitor to do to our plant what the *Bremen*, the *Rex*, the *Normandie* and the *Queen Mary* did to the *Leviathan?* etc.

OF COURSE private investors would also have to consider other problems which the President really does not have to consider. For instance, what local, state and federal taxes might do to the earnings. For instance, whether the Securities Commission would permit them to advertise their bonds by mentioning this certainty of increase in demand for power; the surety that loss in transmission would be decreased; above all, the complete safety of the money invested!

Which is rather important in that virtually every reputable engineer who has examined the proposed project has been convinced that, while perfectly possible, from an engineering standpoint, Quoddy would cost far more than its production of electricity would justify, especially in view of the fact that it is at some distance from any probable market.

To this last point the answer has frequently been made that the market would move to the power supply, indicating a New Deal expectancy that the district around Eastport, Maine, would become a great manufacturing center. This is interesting, but highly speculative. It involves an answer to the question, why have so many textile mills been built in the South, while those in New England have languished? Certainly not because of any lack of cheap power. Mostly because of cheaper labor, longer hours of daylight, mild winters, etc. Whereas Quoddy is far to the north of these languishing textile mills of New Hampshire, Massachusetts and Rhode Island, and much further from the market for manufactured goods.

Economically it is all of a piece, though not quite so spectacular, as the government having spent $50,000,000 while Mr. Roosevelt was assistant secretary of the navy to construct the Alaskan Railway—longer than from Boston to Washington, and with a total population along the line of 6,000, including both terminals, and including Eskimos!

THE argument then was that the railroad would develop the territory—that Alaska would thrive. Today the population is a little less than it was twenty years ago. The pure logic there was excellent also. But the physical facts proved different. Elements not considered at the time—by the Administration—have made the Alaskan railway a financial fiasco.

When the late Theodore Burton, Senator from Ohio, was killing pork barrel river developments by the simple expedient of talking them to death, his favorite phrase was:

"Why, Mr. President, the government could afford to buy every pound of freight which may be offered for transport on this river, and burn it. It would cost the treasury much less than making this stream navigable."

Similarly, the government could transport all freight and passengers over the line of the Alaskan Railway by airplane, without charge, and save a lot of money as compared with interest on investment, maintenance and operating charges of the railroad.

And, in the opinion of engineers, the government would save a lot of money by buying electric power and giving it away at Eastport, rather than proceeding with the construction of Quoddy.

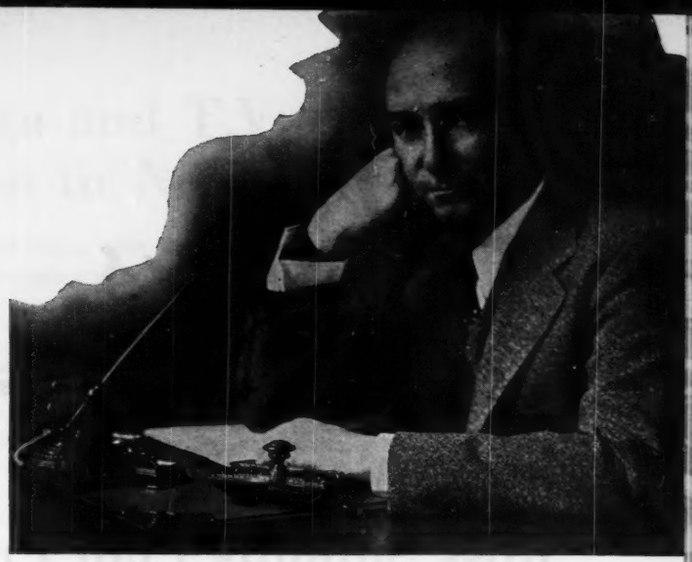
One wonders whether the astute Charley Michelson contrived in some hypnotic fashion to induce Samuel Insull to go to the notification ceremonies for Republican Vice-Presidential candidate Frank Knox at Chicago. And whether he then notified the newspaper and movie camera men that the famous formerly exiled utility magnate would be found, with his wife, on the first floor.

Certainly Michelson thrilled at the result. Here is the best-advertised figure in the whole utility world, a man whose very name is tied up, in the popular mind, with everything that the public has ever resented about the industry, and in addition with everything the gentry who back in 1928 and 1929 thought they were going to get rich hate about Wall Street, watered stocks, high-pressure salesmanship, pyramiding, etc. He is identified as such an enthusastic supporter of the Republican ticket that he attends a meeting designed only for publicity, and intended to whip up G.O.P. enthusiasm!

It makes no difference whatever whether the charges

—By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.



against Insull were unfair. It makes a difference that he was acquitted by a court, but this difference is on the wrong side! He escaped punishment in the view of a tremendous lot of people, and whether he should have been punished, or whether by his exile and notoriety he was punished, has nothing to do with the case.

Presumably Mr. Insull is for the election of Landon and Knox, despite his irritated refusal to be interviewed by reporters at the meeting. But he should have been advised that he is considerably too well known in Chicago to have escaped the notice of the camera men, and that his being at that meeting would be worth a good many hundred thousand dollars in publicity—not to Landon but to Roosevelt!

But it needs no such piling up of logic to prove that Insull is not a figure calculated to bring support to a political candidate. It would be difficult to find any one whose presence at the Knox meeting would have been better news for the Democrats, what with Roosevelt being charged with hostility to the electric industry. But that's only part of the picture.

It would seem that by this time the poorest-informed public relations counsel in the country would realize the advisability of keeping every client whose name is associated in the public mind with big money out of the limelight as far as anti-Roosevelt activities are concerned.

LOOK at the du Ponts! Here is a family which it might be said had helped build up America. Early du Ponts made the powder with which Commodore Peary won the battle of Lake Erie, and which supplied the guns of warships and privateers in that so nearly disastrous—for this country—war.

A glance at the record of American participation in the World War will show that while nearly every other article needed for our armies and navy was long delayed in production, was criticised sharply after it had been produced, or was the subject of whispered or open scandal, the production of explosives seems to have passed unscathed.

The du Ponts have also escaped criticism during the various cycles of muckraking, have never been attacked for rebating, wrecking competitors or whatnot. Above all, the investors of this country have little cause to hate them. Most people who put money in their enterprises have profited.

The drinkers of the country should approve them, for they paid a considerable fraction of the total cost of the campaign which finally resulted in the repeal of the Eighteenth Amendment. Mr. Roosevelt should be grateful to them, for without repeal the deficit in the federal treasury would be just one-and-a-half-billion dollars more—the amount of federal liquor taxes realized by the treasury since repeal—and the growing debt of the federal government would be increasing half a billion dollars faster a year.

But—because eleven persons of the du Pont name attended the famous Liberty League dinner last winter, when Alfred E. Smith attacked Roosevelt for broken platform pledges, it is the almost unanimous judgment, not only of new dealers but of disinterested observers, that the opposition of the once-potent, brown-derbied gentleman has been converted from a New Deal liability to a New Deal asset.

Mind you, this is a fact not a theory. The writer is as much puzzled as any utility magnate as to the why and wherefore. He has propounded the question to literally hundreds of people.

There are only two answers, neither satisfactory. One is that the du Ponts are "rich." The other is that the du Ponts make munitions—hence incur the resentment of peace advocates. That having a big explosives plant might be rather handy if the United States gets into a war does not figure. The theory of so many peace advocates is not "Walk softly—but carry a big stick." It's "Butt into every other nation's business, but don't carry any stick at all."

The whole point is, if you are rich, and especially if you are connected with the utilities, don't break into the newspapers on the Republican side—unless you want to help Roosevelt!

For years Hearst has been educating the people of California, the state in which he has always been most potent, to hate the corporations in general and the utility corporations in particular. The "peepul" should own their utilities, he has insisted.

LATELY the people of San Francisco have begun to wonder a little. At least twice they have voted against plunging the city into debt to build a transmission line to bring the Hetch-Hetchy power to town, despite the insistence of the Public Works Administrator that this must be done. The fact there is that the terms of the law under which Hetch-Hetchy power became available forbid its being sold to a privately owned utility. But the San Franciscans hate to waste all that money!

But Mr. Hearst's alarm about federal spending, piling up federal debt, and sure-to-be-greater federal taxes leaves the "have-nots" utterly cold. And they have been reading in the Hearst papers for lo, these many years, how wicked the corporations are. For of course they know *they* aren't going to pay the taxes.

News OF THE WEEK

Ross Submits Plan Proposing Unification of Federal Systems

Suggests interconnection of Columbia River projects with municipal systems and power districts in Northwest — Cites reasons for preference to state power plan — Maintains region will absorb power

A plan proposing unification of the federal power system on the Columbia River with the municipal systems of Seattle, Tacoma and other west Washington cities and power districts has been presented by City Light Superintendent J. D. Ross of Seattle, who declares such a plan would be worth $100,000,000 to the Pacific Northwest.

Mr. Ross suggests construction of interconnecting transmission lines between the systems at federal expense, to serve local power districts and municipal systems in the various counties at uniform wholesale rates. He advocates this federal-municipal combination in preference to the state power program measure which is to be submitted to the voters at the November election.

Plan of distribution

The municipal systems in Seattle and elsewhere would continue to function under his plan as they do now, Mr. Ross said, but they would gain a market for their waste power and have a mutual "standby" in the federal generating plants in emergencies.

A surplus of power from the Seattle system would be available to the federal plant at Grand Coulee and Bonneville during the summer, when local demands are lowest and Columbia district demands are highest, Mr. Ross states. This would be returned in winter when the situation is reversed.

In discussing the plan of distribution Mr. Ross said: "The federal government is building Coulee and Bonneville and should hold and operate them. The federal government should also build, hold and operate the main transmission lines, not only interconnecting these two plants, but also those main lines required to reach the main centers of distribution. The distribution would be done by the people themselves, in districts that they are now forming, and in the cities by municipal plants, as Seattle, Tacoma, Ellensburg and Blaine are now doing . . . With the federal government selling at wholesale to each district the whole plan becomes exceedingly simple. The government then has the handling of the power plants and lines, and the returning of their cost to the National Treasury. The people have their own power . . .

"A referendum bill for state power," Mr. Ross said, "is to be voted on in November. This bill would tax the people of the State of Washington by the issuance of general lien bonds to the tune of $30,000,000 to be borne by the taxpayer, and would add a host of unnecessary employees to no purpose except interference. Such an added cost certainly cannot bring the low rates we all hope for, which we can easily and quickly bring through the federal and district plan . . . We can easily finance from revenue bonds and not tax the people for power, so why vote $30,000,000 as a tax burden? . . .

"When Muscle Shoals, Boulder Dam, Bonneville, Coulee and all other federal plants are later considered as a unified national system no doubt a schedule of rates for wholesale power will be made . . ."

Purchase of private companies

Commenting on competition with private utilities, Mr. Ross said: "All this distribution of current must be carried out in competition with powerful private systems unless those systems are purchased by the public power districts at a fair price. Competition of the public plants against the private plants brought great reductions in electric rates, but after these reductions were realized the rate was still twice as high as it would be without the cost of duplication, because two electric systems cost twice as much as one . . . Every public plant or district can make great reductions through competition, but it should be only after every effort has been exhausted to purchase the existing private company's holdings at a fair price."

The market—that is the question

As a market for the power, Mr. Ross thinks the normal growth of the region will absorb it in time. He suggests the use of Bonneville power in the Coulee area now to build up the load. He suggests the location of at least sufficient new industries to supply the local market. He suggests a uniform rate schedule for the federal power in all projects, with retail rates modified to meet the needs for each local community. As a market for surplus power he suggests the use of many local steam-electric boiler district heating plants in the cities of the region. He estimates the demand for power in the region as 18,760,000,000 kw.-hr. in 1942.

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"Original Cost" Orders Are Issued

At hearings last week it was announced by the New York Public Service Commission that orders are to be issued to Yonkers Electric Light & Power Company requiring it to change its books so that original costs of the property would be shown thereon. These orders are issued following the recent decision of the New York State Court of Appeals upholding the immediate installation of lower rate scales on a temporary basis pending proof of confiscation (ELECTRICAL WORLD, July 25, 1936, page 6).

Numerous changes in the primary records would be made if the company should accede to the commission's orders, among them, fixed capital reduction of

$573,415, surplus reduction of $418,655, reserves reduced $31,281, accounts receivable increased $97,020, miscellaneous suspense increased $16,728, miscellaneous investments increased $9,730.

When and if these changes are made, the commission is of the opinion that fixed capital accounts will reflect the actual cost of the property to the company.

The proceedings are being watched avidly by a number of utility interests which see the long-range financial disturbances inherent in any situation where a regulatory body assumes the power to alter fixed capital records of a going public utility organization.

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Novel Ideas Feature I.E.S. Lamp Program

The Rocky Mountain Electrical Association has originated a series of unusual ideas for stimulating interest in its approaching I.E.S. lamp campaign throughout Colorado, New Mexico and Wyoming. Several phases of the program already have been perfected; others are being saved for the association's annual convention at Sante Fe, N. M., September 21 to 23.

Every delegate to the convention will sign a Sight-Saving pledge. This pledge will be incorporated in the identification badges which will be issued to indicate payment of the registration fee. The badges will be enlarged replicas of the official I.E.S. tags. The pledge contained on them certifies that the wearer appreciates the importance of proper lighting, will use one or more I.E.S. lamps for better seeing, and that he will make every effort to promote the cause of Better Light-Better Sight.

One of the provisions governing the convention will be a fine of one-standard, three-light I.E.S. floor lamp for failure to wear the official badge.

Another novel touch to the convention will be introduction of the largest I.E.S. tag in the nation.

Several of the nation's foremost authorities on illumination are included in the program. They and others will discuss the value of the lighting load to electric light companies.

Chattanooga and T.V.A. Jockey for Position in New Agreement

Who will sign, who can sign, who will sign first, does legal authority exist are questions befogging City-T.V.A. agreement

Special—From the Washington Bureau of ELECTRICAL WORLD

Tennessee Electric Power Company, one of the nineteen utility companies engaged in a court test of the constitutionality of the Tennessee Valley Authority, secured a temporary injunction to prevent the city of Chattanooga, Tenn., from obtaining power from T.V.A. The injunction was granted by Judge A. T. Faest of the state Chancery Court.

Coming just as the City Council was considering the proposed contract, the injunction move was preceded by an amendment to the suit now pending before the federal court at Knoxville asking that court for an injunction halting further T.V.A. activities or extensions pending final determination of the issue. In the event that the utilities should win the suit, they ask permission to force T.V.A. "to restore conditions existing at the present time."

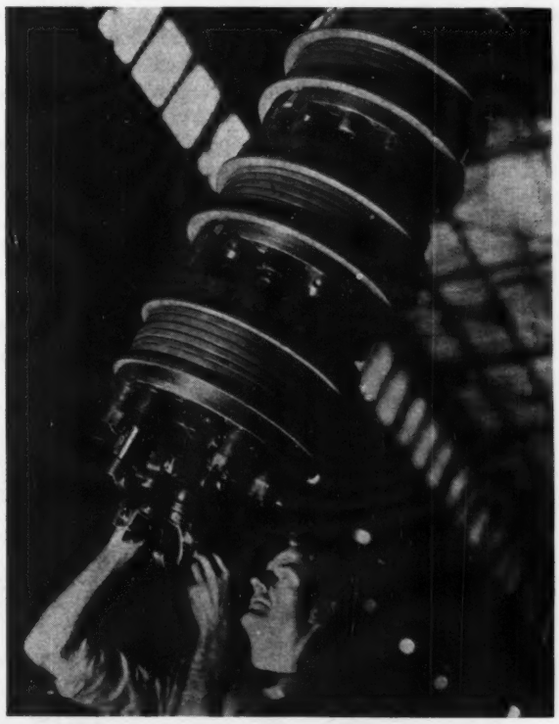
After long months of preliminary negotiations between the city of Chattanooga and the Tennessee Valley Authority, some signatures have been affixed to the new contract between the parties and Chattanooga citizens committed to T.V.A. kilowatts, T.V.A. taxes or T.V.A. lawsuits. Maybe to all three.

Known locally as "The Dynamo of Dixie," it is doubtful in the opinion of informed observers that Chattanooga will soon whir with T.V.A.'s kilowatts due to two legal questions which may be raised shortly. First question is: Does the "Chattanooga Electric Power Board" have authority to sign for the city? Second question: If so, has the board the power to create $8,000,000 of new obligations to rest upon the citizens?

Latest advices to ELECTRICAL WORLD indicate that City Attorney Joe W. Anderson has been successful in absolving the city from any direct connection with the contract and has successfully passed responsibility to the city power board, headed by Col. Howard C. Fiske.

Doubts existing in T.V.A. circles as to authority of the power board created by the 1935 Tennessee Legislature have now been dispelled, it is said, as T.V.A.'s General Solicitor James Fly has revoked previous insistence that the city commission authorize and direct the Mayor to sign for the city. Meanwhile the five members of the power board have signed and execution by T.V.A. is considered to be imminent.

OPERATES WITHIN 3 CYCLES



This grid assembly is half of the interrupters in a single-pole unit of a three-phase breaker with an interrupting rating of 2,500,000 kva. at 287,500 volts. These Westinghouse Deïon grid interrupters for Boulder Dam circuit breakers open in less than three cycles

T.V.A. moves along many fronts

V. D. L. Robinson announces that construction of a 30-mile transmission line between Chickamauga Dam and Watts Bar damsite is to begin today. The line will tie in with the Norris-Wilson line, will consist in part of 21 steel towers, will employ about 200 men and is expected to be completed in approximately four months.

W. W. Woodruff, T.V.A. engineer of construction design, will be in charge of the project, Mr. Robinson said.

H. W. Meeks, superintendent of Alcorn County Electric Power Association, has announced that the 10 per cent surcharge on standard T.V.A. retail rates is to be dropped from August bills, as was done in Tupelo, and 2,093 members may expect lower bills as a result.

From Natchez, Miss., word comes that Franklin, Jefferson and Amite Counties are being surveyed by L. C. Smith and

Harris Butler of the State Planning Commission for a 112-mile rural line served by T.V.A.

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No Power Shortage Exists in T.V.A. Areas, Say Companies

At a press conference this week President Roosevelt said the T.V.A.-Commonwealth & Southern power agreement might not be canceled by T.V.A., as announced (ELECTRICAL WORLD, August 8, 1936, page 5), and, in fact, might be extended.

The President's contention that a "power shortage" exists in T.V.A. areas is flatly contradicted by utility spokesmen. Instead, it is said, T.V.A. must continue the agreement to provide an important outlet for Norris Dam power. This outlet would disappear should the constitutionality of T.V.A. fail to be conceded in impending Supreme Court cases.

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Miami Lighting Show Highly Successful

Florida electrical dealers, architects, members of the building trades, students and professors of electrical engineering, and public utility men attended the Commercial Industrial Lighting Conference and Exposition held recently at Miami. This conference, sponsored by the Florida Power & Light Company under the direction of A. C. Bergh, lighting specialist, was planned to present new concepts in art and practice of lighting.

This was Florida's first state-wide commercial - industrial lighting conference. More than a hundred delegates were in attendance at the opening session, and before the close of the two-day conference 260 had registered. Planned primarily for Florida Power & Light men, representatives from 26 cities in their system were present, and seven districts outside this chain had men in attendance. Nine out-of-state districts were also represented.

The conference program included discussions of "Light for Seeing Activities," "Co-ordination of Light and Architecture," "Architectural Lighting," and "Lighting for Selling." The speakers were J. M. Ketch, A. L. Powell, M. E. Olson, D. B Clark, all of General Electric Company; J. L. Stair, Curtis Lighting, Inc.; S. J. Lough, Holophane Company; Charles Burch, Pittsburgh Reflector Company, and E. C. Knox, electrical inspector of the city of Miami.

Some 34 exhibitors co-operated by showing lamps of various kinds. The lamp mart, held after the close of the conference, displayed several hundred I.E.S. lamps, designed by seventeen national lamp manufacturers.

New $4,593,300 R.E.A. Allocation Makes Grand Total of $19,550,000

Latest appropriation marks final stage in evolution of R.E.A. from emergency to permanent status — Future funds will come from Reconstruction Finance Corporation instead of Emergency Relief

Nineteen new allocations totaling $4,593,300 have been made by R.E.A. This brings the total amount of R.E.A. funds lent or definitely earmarked to $19,554,028. This money is to finance more than 17,750 miles of distribution lines serving 67,000 farm customers that have never before had electricity. With these allocations R.E.A. has definitely changed its status from an emergency to a permanent agency as provided by Congress.

Heretofore R.E.A. loans have been drawn against earmarked funds available under the Emergency Relief Appropriation Act of 1935. Henceforth the Rural Electrification Act provides that loans will be made for the fiscal year ending June 30, 1937, from funds of the Reconstruction Finance Corporation.

Colquitt County Rural Electric Company of Moultrie, Ga., has received $275,000 to build 260 miles of rural lines in Colquitt, Brooks, Mitchell, Thomas, Tift and Worth Counties. Power will be supplied at wholesale by the city of Moultrie.

Franklin County Electric Co-operative of Greenville, Mass., has received $200,000 to build 180 miles of lines in Franklin and Hampshire Counties.

Buffalo County Electric Co-operative Association of Arcadia, Wis., has received $260,000 to build 252 miles of rural lines in Buffalo and Trempealeau Counties. Power will be supplied by the City of Arcadia.

North Georgia Electric Membership Corporation of Ringgold, Ga., has received a supplementary allotment of $237,600 for building 219 miles of line in Catoosa, Whitfield, Dade, Chatooga, Floyd, Murray, Gordon and Walker Counties in Georgia and in Hamilton County, Tennessee.

Federated Rural Electric Association of Jackson, Minn., has received a supplementary allotment of $121,000 for building 150 miles of line in Jackson and Martin Counties.

Johnston County Electric Membership Corporation has received a supplementary allotment of $230,000 for building 230 miles of lines in Johnston, Wake and Harnett Counties, North Carolina.

Northwestern Rural Electric Co-operative Association of Meadville, Pa., has received a supplementary allotment of $299,000 for building 251 miles of line in Crawford and Erie Counties, and possibly a Diesel generating plant if a satisfactory wholesale source cannot be found.

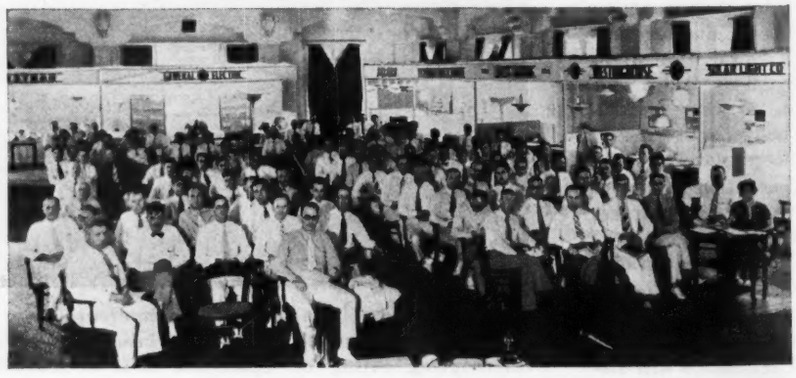
Rock County Electric Co-operative Association of Janesville, Wis., has received a supplementary allotment of $325,000 for building 319 miles of line in Rock, Dane, and Walworth Counties.

New allocations of R.F.C. funds

The projects in the following paragraphs were originally allotted funds from the Emergency Relief, but their original grants have been rescinded and new allocations have been made from R.F.C. funds. In every case the original grants have been increased.

Scott County Electric Co-operative of

NO MIDSUMMER SLUMP IN FLORIDA



Record-breaking sales figures can be expected when this crowd gets started. Managers and sales executives of Florida Power & Light Company gather at Miami to map out new selling campaign

Winchester, Ill., has received $105,000 to build 85 miles of lines in Scott County.

Pike County Electric Co-operative of Pittsfield, Ill., has received $385,000 to build 362 miles of lines in Pike, Calhoun, Scott and Adams counties in Illinois and Marion County in Missouri.

Menard County Electric Cooperative of Petersburg, Ill., has received $135,000 to build 116 miles of lines in Menard, Sangamon, Cass and Logan Counties.

Rural Electrification Convenience Co-operative of Virden, Ill., has received $260,000 to build 232 miles of line in Sangamon, Christian, Montgomery, Morgan and Macoupin Counties.

Henry County Rural Electric Membership Corporation of Newcastle, Ind., has received $413,000 to build 378 miles of line in Henry, Delaware, Fayette, Hancock, Madison, Randolph, Rush and Wayne Counties.

Monona County Rural Electric Co-operative of Onowa, Iowa, has received $245,000 to build 243 miles of line in Monona, Woodbury, Harrison Counties.

Shelby County Rural Electric Co-operative of Harlan, Iowa, has received $267,500 to build 250 miles of line in Shelby, Cass, Harrison and Pottawattamie Counties.

Marion County Electric Co-operative of Palmyra, Mo., has received $330,000 to build 320 miles of line in Marion, Lewis, Monroe, Shelby and Ralls Counties.

Lewis County Electric Co-operative of Monticello, Mo., has received $235,000 to build 225 miles of line in Lewis, Clarke and Marion Counties.

Southern Nebraska Rural Power District of Hastings, Neb., has received $428,000 to build 351 miles of line in Adams, Kearney and Phelps Counties.

Four More Nations to Attend Congress

Latest acceptances bring total to fifty—British delegates nominated — President Roosevelt to address session

Acceptances from four more nations have been received by the American National Committee of the Third World Power Conference, bringing the total to 50 countries that have announced participation in the conference. New Zealand, Guatemala, Colombia and Netherlands East Indies have just notified the committee of their plans to participate in the conference and will send delegates.

R. J. Harvey, consulting engineer, has been appointed the official delegate of New Zealand, and Engineer Luis Schlesinger Carrera will represent Guatemala; Wouter Cool, general secretary of the Royal Institution of Engineers, Netherlands East Indies. The Colombian delegation has not yet been chosen.

Premier Baldwin has nominated the following official delegates to represent the government of Great Britain: Lord Falmouth, vice-president Conjoint Conference of Public Utility Associations; N. G. Gedye, British delegate to the International Commission on Large Dams of the World Power Conference; T. Hardie, director Gas Light & Coke Company; J. M. Kennedy, Electricity Commissioner; Dr. F. M. Lea, Department of Scientific and Industrial Research; C. H. Merz, member British National Committee of the World Power Conference; Sir Archibald Page, chairman Central Electricity Board; C. Rodgers, deputy-director British Electrical and Allied Manufacturers' Association; Dr. F. S. Sinnatt, director of fuel research, Department of Scientific and Industrial Research; E. T. Williams, assistant director of electrical engineering, British Admiralty.

Official representatives from public and private organizations in 45 states have been named to attend the conference. More than 300 such representatives have been selected to attend the meeting on behalf of state and local governments and research organizations. Governors of sixteen states have thus far appointed official representatives and a dozen other states will send officials of their public utility commissions. The remaining states will be represented by business men, university officials, etc.

President Roosevelt will address a joint session of the Third World Power Conference and the Second Congress on Large Dams on Friday afternoon, September 11, at Constitution Hall, it was announced at the White House last week. Present on this occasion will be about 700 or more foreign dignitaries, designated by their governments to attend the conference, members of the Diplomatic Corps, government officials and representatives of the utility industry.

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The "Sun Motor" Emerges Again

"There will come a time, probably still far distant, when coal and oil will be luxuries," said Dr. C. G. Abbot, secretary Smithsonian Institution, this week in connection with the World Power Conference announcement that his model "sun motor" would be displayed and operated at the conference.

"Hydro-electric power will always be available," he continued, "but it may well be that the inexhaustible energy of the sun's rays, millions of times exceeding all probable demands, will be called upon. If so, it is hoped that these studies I have made of efficient methods to utilize the sun's rays for power may lead to an economic solution."

Present plans contemplate that World Power Conference visitors may view a combination of parabolic mirrors, "Pyrex" tubes and a commercial solution called "Avoclar." Thus the "sun motor" emerges again, reminding power engineers of woodcuts in very old textbooks which depicted previous sun motors, terrestrial magnetism motors, tide power generators, and other stimuli to youthful imaginations.

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Detroit Edison Calls Bonds

Detroit Edison Company has called for redemption on October 1 at 107½ and accrued interest the outstanding general and refunding mortgage 5 per cent bonds, series C, due August 1, 1962.

FLOODLIGHTING WORLD'S FAIR SITE

Charles Poey, lighting bureau manager of New York & Queens Electric Light & Power Company, floodlights the site of New York's 1939 World's Fair. Work proceeds day and night, and 345 Westinghouse AFA-20 floodlighting units preclude use of automobile and truck headlights

Steam Replaces Hydro in Drought States

Advent of what has proved to be the worst drought on record has cast a forbidding shadow on the government's "glittering" hydro program. The drought, according to figures of both the Edison Electric Institute and the Federal Power Commission, has made deep inroads into the amounts of hydro power usually generated during this period of the year. Although the output of all electric light and power plants has continued at record levels, thanks to reserve steam capacity, there has been a marked falling off in the generation of electricity by hydro plants and a sharp rise in the amount of steam-generated energy. Hydro, it would seem, is not, as the government would have us believe, an infallible power source.

The West Central and Central Industrial regions are perhaps the worst hit. The West Central region includes the states of Minnesota, which last year generated over 45 per cent of its output by water power; Iowa, with 50 per cent of its output coming from water power, and Missouri, with 38 per cent hydro generated output, according to last year's figures. In the Central Industrial region is Wisconsin, which generated 2,291,000,000 kw.-hr. last year, of which 48 per cent was from water power.

The following tabulation, based on Federal Power Commission figures, clearly reflects the effect of drought conditions on hydro and steam generated output in several of the states:

	Hydro Thousand Kw.-Hr.	Steam Thousand Kw.-Hr.
Minnesota		
May	77,320	25,661
June	61,908	67,859
Iowa		
May	90,497	82,610
June	75,917	84,586
Missouri		
May	9,312	90,843
June	7,754	100,630
Nebraska		
May	4,801	51,136
June	3,927	53,227
Kansas		
May	1,567	96,282
June	1,452	104,167
Wisconsin		
May	121,509	92,714
June	76,360	109,509
Michigan		
May	116,170	337,329
June	88,107	350,291

Stocks of coal held by electric power utilities on July 1, 1936, amounted to 6,647,563 net tons, which is a decrease of about 0.8 per cent compared to June 1, 1936, and 16.1 per cent below stocks on July 1 last year. Utility plants consumed 3,309,361 net tons of coal in June, 1936, an increase of 12 per cent over the 2,954,062 net tons consumed in May. This is a further indication of the increased use of steam occasioned by the drought.

•

June Air Units Orders

Orders booked by 98 manufacturers of air-conditioning systems and equipment had a value of $4,336,636 in June, compared with $4,412,681 in May, a decrease of 1.7 per cent, the Department of Commerce reports. June orders brought the total for the first six months of the year to $20,416,446.

Meetings

Illuminating Engineering Society—Annual convention, Statler Hotel, Buffalo, N. Y., August 31-September 3. A. D. Cameron, general secretary, 29 West 39th Street, New York.

Third World Power Conference—Washington, D. C., September 7-12. Joel Wolfsohn, executive secretary, Interior Building, Washington, D. C.

International Association of Electrical Inspectors—Western section, Brown Hotel, Louisville, Ky., August 31-September 3; Eastern section, Hotel New Yorker, New York, September 8-10; Northwestern section, Olympian Hotel, Olympia, Wash., September 14-16; Southwestern section, Hotel Fresno, Fresno, Calif., September 21-24; Southern section, Hotel Adolphus, Dallas, Tex., September 28-October 1.

Pennsylvania Electric Association—Annual meeting, Bedford Springs Hotel, Bedford Springs, Pa., September 9-11. Harold A. Buch, secretary, Telegraph Building, Harrisburg, Pa.

National Electrical and Radio Exposition—Grand Central Palace, New York, N. Y., September 9-19. Ralph Neumuller, secretary, 480 Lexington Avenue, New York, N. Y.

Maryland Utilities Association—Mid-year meeting, George Washington Hotel, Ocean City, Md., September 12. E. J. Hand, secretary, Clayton Building, Elkton, Md.

West Virginia Public Utilities Association—Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., September 18-19.

Rocky Mountain Electrical Association—Annual convention, Santa Fe, N. M., September 21-23. George E. Lewis, managing director, Gas and Electric Building, Denver, Colo.

Association of Iron and Steel Engineers—Annual convention, Detroit, Mich., September 22-25. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

National Electrical Wholesalers Association—Semi-annual convention, Hotel Statler, Buffalo, N. Y., September 28-30. E. Donald Tolles, managing director, 165 Broadway, N. Y.

Empire State Gas & Electric Association—Annual meeting, Saranac Inn., N. Y., October 1-2. C. H. B. Chapin, secretary, Grand Central Terminal, New York, N. Y.

Indiana Electric Association—Annual convention, French Lick, Ind., October 1-2. T. C. Polk, secretary-treasurer, 609 Traction Terminal Building, Indianapolis, Ind.

National Electrical Manufacturers Association—Netherland Plaza Hotel, Cincinnati, Ohio, October 4-10. W. J. Donald, managing director, 155 E. 44th Street, New York.

Electrochemical Society—Fall meeting, Niagara Falls, Ontario, October 7-10. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Tenant-Farm Wiring Now Suggested

"Three of the nation's farm leaders, representing more than 2,000,000 farmers, today urged American landowners to follow the example of Holland and France and include their tenant houses in rural electrification projects," the Rural Electrification Authority said this week.

The gist of the appeal was that social benefits would accrue to the tenant, while the landlord would profit in dollars and cents because electrification of the farm would attract a higher type tenant, reduce tenant turnover, lower fire hazard and increase the salable price of the property.

The three men were Edward A. O'Neal of Chicago, Ill., president of the American Farm Bureau Federation; L. J. Taber of Columbus, Ohio, master of the National Grange, and Howard A. Cowden, Kansas City, Mo., president of the Consumers Co-operative Association. Each expressed his opinion in a letter addressed to Rural Electrification Administrator Morris L. Cooke.

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Stock Goes Directly to Stockholders

Stockholders of United States Electric Power Corporation have been given the opportunity to buy common and class B stock of Standard Power and Light now owned by their corporation at a price of $2.80 per share, the syndicate holding United States Electric Power notes has announced. This "offering" was contemplated some months ago (see ELECTRICAL WORLD, June 6, 1936, page 104).

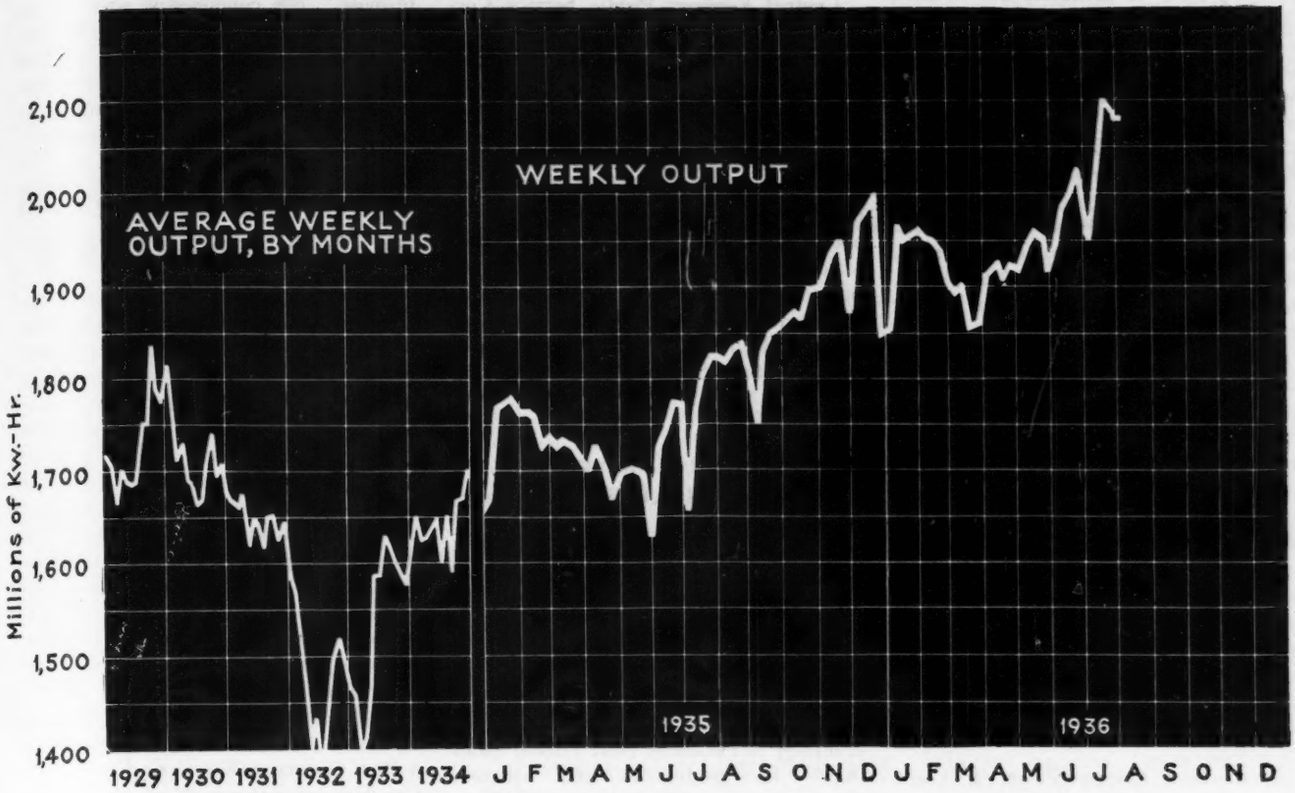
No change was apparent in the control of the Standard Gas & Electric Company, now in reorganization, as the 75 per cent of class B stock of Standard Power & Light is still held by H. M. Byllesby & Company. Interesting developments are expected, however, in connection with imminent refunding operations for subsidiary companies.

•

E.H.F.A. Announces 5% Discount Rate

Electric Home and Farm Authority announced that effective August 10, 1936, all paper accepted by it covering the sale of electrical appliances would be purchased at a discount rate of 5 per cent per annum. This means that the only charge which will be made to the purchaser of such appliances by Electric Home and Farm Authority will be a discount rate of 5 per cent per annum for the term of the contract.

Output Only 1 per Cent Under Record



Interest in the output of electric light and power plants for the week ended August 8, quoted as 2,079,149,000 kw.-hr. by the Edison Electric Institute, is twofold. First, output for the week of August 8 remains exactly where it was the week before, less than 1 per cent below the all-time high established during the week of July 18 and better than 20 per cent above the corresponding week of 1929. This tendency to hover at record-breaking levels is an encouraging sign of increased activity on all fronts. Secondly, output has been maintained at present high levels in spite of drought conditions that are making inroads into hydro capacity. Sharp drops in regional gains are apparent in the drought regions (Central Industrial and West Central), where output is being maintained by use of reserve steam capacity. Balancing the drop in regional gains in drought states, a sharp rise is to be noted in New England and the Middle Atlantic states.

Weekly Output, Millions of Kw.-Hr.

1936		1935		1934	
Aug. 8	2,079	Aug. 10	1,819	Aug. 11	1,659
Aug. 1	2,079	Aug. 3	1,821	Aug. 4	1,658
July 25	2,088	July 27	1,824	July 28	1,684
July 18	2,100	July 20	1,807	July 21	1,664
July 11	2,030	July 13	1,766	July 14	1,648
July 4	1,956	July 6	1,655	July 7	1,556

Per Cent Change from Previous Year

	Week Aug. 8	Week Aug. 1
New England	+15.9	+12.7
Middle Atlantic	+14.0	+10.9
Central Industrial	+16.5	+18.2
West Central	+ 7.4	+10.6
Southern States	+15.5	+18.4
Rocky Mountain	+15.0	+16.0
Pacific Coast	+10.6	+ 9.5
United States	+14.3	+14.2

Expansion Program Starts in Arkansas

Arkansas Power & Light Company is engaged in an improvement and expansion program in Little Rock and North Little Rock involving the expenditure of more than $40,000, according to R. E. Ritchie, vice-president and general manager. About $20,000 is being spent in construction of additional service facilities in the underground distribution system, and an equal amount is being spent improving overhead equipment. The work involves the stringing of additional power lines, installing new and larger transformer banks and making other changes.

Mr. Ritchie stated that at the present time the company's peak capacity is only 12,000 kw., with the Little Rock plant having a supply output of 13,000 kw. and the Dixie substation in North Little Rock an output of 20,000 kw., giving the company a total available supply of about 33,000 kw. to supply a peak load demand of only 12,000 kw.

•

Power Committee for New York

The administration committee of the New York committee for the Third World Power Conference was recently announced by E. C. Hutchinson, chairman for New York. The committee will be in charge of all activities for that portion of the delegates who pass through New York en route to Washington.

The committee is composed of R. M. Gates, reception; E. C. M. Stahl, transportation; C. L. Law, hotels and local services; J. L. Lawrence, headquarters and registration; O. B. Blackwell, New York technical tours, and Dr. L. M. Gilbreth, Mrs. R. V. Wright and Mrs. G. W. Farny, women's activities.

Dr. William Durand, who will act as chairman of the World Power Conference meetings, has found the solution of his linguistic problem of addressing representatives of 48 nations. He will welcome them in four languages, English, French, German and Spanish. He speaks all of them fluently, it is reported.

Refunding Continues Despite Summer Lull

Louisville Gas & Electric Company has filed an application with S.E.C. for refunding $28,000,000 bonds at 3½ per cent to effect an interest saving of $200,000 a year. The bonds will refinance existing indebtedness consisting of $20,805,000 in 5 per cent bonds due 1952 and $6,000,000 in 4½ per cent bonds due 1961. The cost of redeeming the bonds will approximate $29,779,875, the balance to be provided out of the company's funds.

Kansas City Power & Light Company recently called for redemption on October 2 first mortgage bonds totaling $38,000,000. The bonds, which bear 4½ per cent interest, will be replaced with a similar amount of first mortgage bonds bearing 3¾ per cent interest, disposed of at private sale.

According to current reports, the forthcoming Central Maine Power Company $9,000,000 refunding issue may cary a 3½ per cent coupon. The issue has been in registration for a month, but consummation of the sale and fixing of the price are held up until later in the summer.

Cumberland County Power & Light Company late this year may call its 4½ per cent bonds due in 1956 and replace them with a 3½ per cent issue, it is reported.

Public Service Company of New Hampshire has offered $1,000,000 3½ per cent first mortgage bonds, series E, due August 1, 1961. The offering price will be at 104.125 plus accrued interest. Any or all of these bonds will be redeemable at the company's option on 30 days' notice at 105 to August 1, 1941; at 104 thereafter to August 1, 1946; at 103 thereafter to August 1, 1951; at 102 thereafter to August 1, 1956; at 101 thereafter to August 1, 1960.

Central Vermont Public Service Corporation has changed to September 14 public offering date of its proposed $7,000,000 issue of series B first mortgage bonds. The company has also obtained permission from S.E.C. to issue promissory notes aggregating not more than $1,800,000, which can bear interest at not more than 3 per cent and run for not more than nine months. The notes, which will later be replaced by the company's new first mortgage bonds, will enable the company to retire Rutland Railway, Light & Power Company bonds which mature September 1.

•

British Utility Increases Capital by 100,000 Pounds

Capital of Associated Electrical Industries, Ltd., has been increased to £6,495,000 from £6.395,000 by creation of 100,000 shares of 8 per cent cumulative preference stock of £1 par.

At the same time, the company has decided to make an offer at an early date to shareholders of Edison Swan Electric Company to exchange their Edison Swan shares for preference and common shares, respectively, of Associated Electrical. Edison Swan is controlled by Associated Electrical Industries, Ltd.

•

Timing Experiment Set No Precedent, Says Commission

The "timing" device used by Morgan, Stanley & Company in the New York Edison Company $30,000,000 refunding issue (ELECTRICAL WORLD, June 20, 1936, page (53) did not establish a precedent, Securities and Exchange Commission announced Wednesday.

"Although the procedure which you propose," the commission wrote to an inquiring company, "was permitted by the commission in the case of the New York Edison issue, the commission consented to the company's plan only as an experiment and so advised the company."

•

Bond Issue Canceled by Wisconsin Group

Cancellation of a $1,100,000 bond issue of the Wisconsin Power & Light Company and dissolution of ten non-operative subsidiaries of the utility were announced by the Wisconsin Public Service Commission recently. The commission said that the company had decided not to make the mortgage bond issue, which was authorized by the commission May 27, and has asked refund of the $1,100 filing fee it posted in asking permission for the bond issue. It was declared that written approval of the Governor, the Secretary of State, the state Treasurer and the Attorney-General is necessary before the fee can be returned.

The ten subsidiary companies to be dissolved are the Wisconsin Power, Light & Heat Company, Wisconsin River Power Company, Southern Wisconsin Power Company, Southern Wisconsin Electric Company, Beloit Water, Gas & Electric Company, Central Wisconsin Utilities Company, Janesville Electric Company, Middle Wisconsin Power Company, Mineral Point Public Service Company and the Sheboygan Electric Company.

•

Public Service Subsidiary Calls Bonds for Redemption

Public Service Subsidiary Corporation, controlled by Public Service Company of Northern Illinois, has called for redemption on September 10 the outstanding 5½ per cent debentures, series A, due January 1, 1949. As of December 31, last, there were outstanding $5,141,000. The debentures will be called at 103¼. Funds for redemption, it is understood, will be provided without public financing.

Redemption of the Subsidiary Corporation debentures will be a step which will facilitate dissolution of the subsidiary, all of whose stock is owned by Public Service Company, should the management deem such a step desirable.

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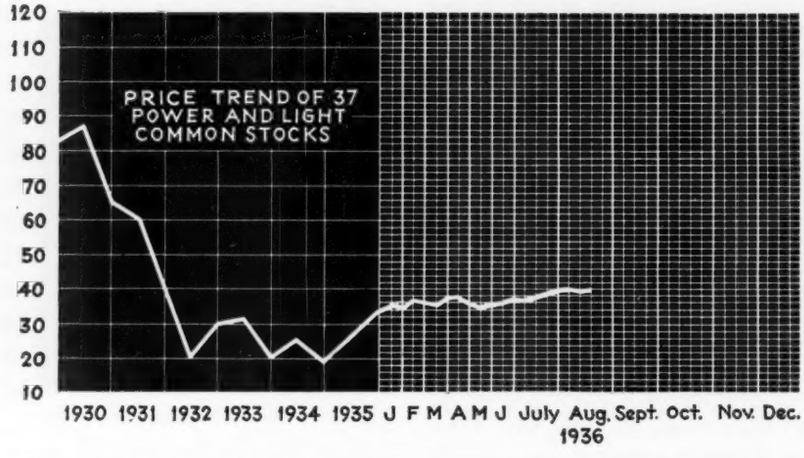
Republic Electric Power Petitions for Exemption

Republic Electric Power Corporation of San Francisco, Calif., has made application for exemption under Section 13(a) of the Public Utility Holding Company Act of 1935.

Utility Stocks Advance



Prices of electric light and power stocks moved upward this week. Gains carried the "Electrical World" index from 38.5, last week, to 39.8

Manufacturing AND MARKETS

Power Exposition Plans Take Form

Preparations for the Twelfth National Exposition of Power and Mechanical Engineering are now going forward. The exposition will open on November 30 in the Grand Central Palace, New York. The American Society of Mechanical Engineers will as usual hold its annual meeting in New York during exposition week. Recently the American Society of Refrigerating Engineers announced that it also would hold its meeting in New York at the same time.

Early reports on products and equipment which will be seen at the exposition include mention of an improved variable-speed transmission available with immediate, remote, manual or automatic speed control. This is said to offer revolutionary advancement in increased production and lower operating costs. Another variable-speed transmission, equipped with anti-friction bearings, is recommended as being compact and quiet.

There will be modern dust-collecting systems and vacuum cleaning systems which through contrast bring to mind the antiquated broom that, less than two generations ago, "cleaned" our factories. Exhibits of industrial lighting will set a standard for optimum factory illumination. There will be on display an insulation system which provides underground and outdoor insulation for lines carrying superheated or saturated steam, and hot or cold liquids.

•

Dealers Seek to Shorten Guarantee Period

The Electric Refrigeration Bureau of Birmingham, Ala., has dispatched letters to manufacturers asking that they get together on a unified plan of guaranteeing electric refrigerators for only one month. Maintaining that five to ten years is too long a period to guarantee any piece of machinery, dealers have pointed out that automobiles costing three or four times as much as refrigerators are guaranteed for only 90 days. The action was taken on complaints of dealers that they are having trouble with the long guarantees as customers expect them to service refrigerators during the guarantee period and certainly until the boxes are paid for under the long terms now prevailing.

•

Blaw-Knox Net Doubles

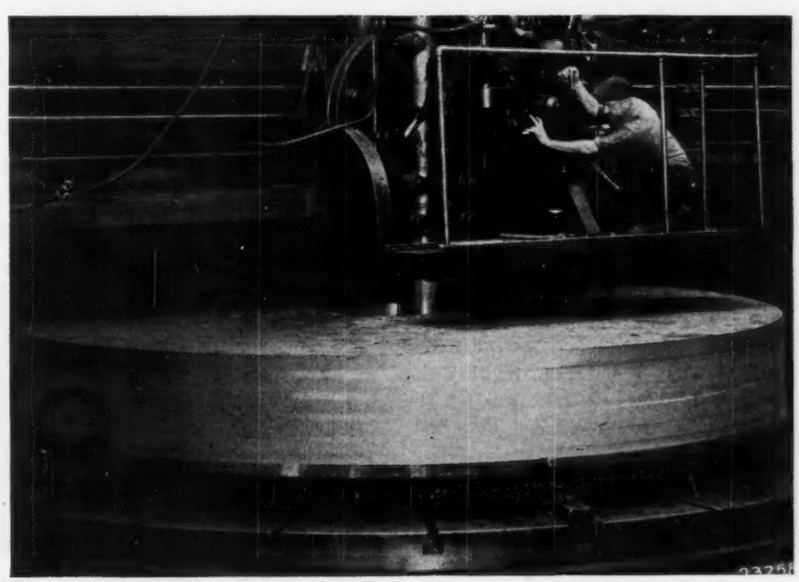
For the six months ended June 30 Blaw-Knox Company reports net profit, after federal income taxes and other charges, totaling $675,293, equal to 51 cents each on 1,322,395 no-par capital shares, compared with $301,448, or 22 cents a share, for the similar period of 1935. No provision was made for federal surtax on undistributed profits in 1936.

New Lighting to Fit Individual Job Needs

New possibilities in factory lighting to fit the specific needs of the job were disclosed at a recent group meeting of industrial lighting specialists and field representatives of the General Electric Vapor Lamp Company, held at Nela Camp, Nela Park, Cleveland. Particular emphasis was laid on the increased flexibility, both from the visual and economic standpoints, which has come about with the development of the new bulb-type mercury lamps and various color-corrected combinations of mercury-incandescent light sources.

W. A. D. Evans, president of the General Electric Vapor Lamp Company, sounded the theme of the meeting. "Industry at last is becoming light conscious," he said, "but that is only the

FLYWHEEL FOR 6,000-KW. MOTOR-GENERATOR SET



This 80-ton flywheel shown on a boring mill in the shops of the Westinghouse Electric & Manufacturing Company is to be part of a 6,000-kw. motor-generator set for the Carnegie Steel Company's new plate mill. Fifteen feet in diameter, it will operate at 375 r.p.m. and equalize the load from the reversing motor, keeping the variations in power drawn from the line within 25 per cent

first step in giving to lighting its proper recognition as a production tool. Our next step is to create a consciousness of the need to choose the individual 'lighting tool' best suited to each type of work.

"Enough light, in itself, does not necessarily create good seeing conditions," Mr. Evans continued. "Distribution of the light to avoid glare and objectionable shadows, its color characteristics and ability to provide a cool, comfortable visual effect, as well as the justifiable cost for such lighting, are all factors requiring guidance on the part of the industrial lighting specialist equipped with a knowledge of all the 'tools' available, gaseous and incandescent, old and new."

•

Aluminum Company Grants Pay Increase to 20,000

An increase of approximately 5 per cent in wages for 20,000 employees was granted last week by Aluminum Company of America, effective on September 15. This is the second wage increase of about 5 per cent made by the company within ten months, a similar increase having been given on December 1 last. With the new advance, officials said the average hourly wage rate would be 11 per cent higher than in 1929.

•

General Electric Bids Low

The Metropolitan Water District of Southern California received low bids, totaling $716,721, on transformers to be installed in four of the pumping plants on the Colorado River aqueduct project. Fifteen transformers will be installed to step down Boulder Dam energy from 23,000 volts to 6,900 volts. The low bidder on the order was the General Electric Company.

Designed to lift ultimately a billion gallons of water daily, a total of 1,600 ft., on the 390-mile aqueduct from the Colorado River to points of use, the aqueduct is the world's largest pumping project. Aqueduct pumping will use 36 per cent of the electrical energy to be generated at Boulder Dam, making the Metropolitan Water District project the largest single customer for dam power.

New York Metal Prices

	Aug. 5, 1936 Cents per Pound	Aug. 12, 1936 Cents per Pound
Copper electrolytic	9.75*	9.75*
Lead, Am. S. & R. price	4.60	4.60
Antimony	11.375	11.00
Nickel ingot	35.00	35.00
Zinc spot	5.175	5.175
Tin Straits	42.875	43.30
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley.

Field Reports on Business

Reports to ELECTRICAL WORLD *from the field indicate that business has maintained its high level of activity and is looking forward to bigger and better things in the fall and winter. All reports from the retail lines confirm the unusual bustle in distributive channels, while the steady character of steel operations attests the recovery being staged by heavy industry. Building increases tell the same happy story.*

NEW YORK

Business continues serenely on its way toward recording the best third quarter in many years. And every preparation is being made for a fall and winter season that will eclipse anything so far seen in the recovery. Words of caution, such as those of Alfred P. Sloan, Jr., in General Motors' second quarter report, fall on deaf ears, so unbounded has optimism become.

Many sober observers feel that business has generated the momentum to carry it on up, regardless of the fact that many lines may be speculating on inventories. Drought may be discounted, they feel, because most sections of the country will benefit from the higher prices brought on by the disaster in the Middle West.

Thus it is that orders are piling up on the steel industry, which continues at recent high levels despite some shutdowns for vacations. Steel companies could already book business in many types of products for October delivery if they weren't expecting better prices by then. And retail lines are booming; July resulted in big gains, and not even the mail order houses, which depend largely on the farmer, felt the drought.

Electric power production continues far above the two-billion mark each week—has missed in only one week of the last eight. And the outlook for autumn is bright if industrial activity booms, as most seem to expect. These high production marks promise orders for generating equipment, while electrical manufacturers continue to benefit in lighter categories from the larger increase in building.

NEW ENGLAND

Sales of electrical equipment during the first fortnight of August were of such volume for this year as to arouse very favorable comment by manufacturers. Power apparatus orders are reported in good volume; small motor sales are quite brisk and inquiries are being received for motors and control equipment for a number of pumping installations.

Line materials are spotty; some pole line hardware is being bought and the usual summer replacements on distribution systems in the northern areas are responsible for scattered orders. A new substation for the New England Power Company costing about $300,000 will be built in conjunction with the new Tewksbury-Melrose line.

Some special electrical apparatus sales are of interest; electric furnace sales recently recorded included a special type electric furnace for a Rhode Island silverware manufacturing company; a furnace of the atmospheric control type has been purchased by a Hartford, Conn., company. Street illumination is attracting attention and street lamp sales are moving well; floodlighting for service stations is under consideration for a number of new projects. A group of thirteen floodlights were recently installed at the East Cambridge, Mass., jail.

Merchandising is reported somewhat uneven in trend; within the past two months 350 apartment house electric ranges have been sold in the greater Boston area.

PACIFIC COAST

Still rather incredulous after several lean years, contractors and wholesalers are gradually admitting that present building activity ranks with that of 1929 and that, though it is preponderately residential and institutional, there are signs that industrial construction and reconditioning will soon be a balancing factor. July reports reveal another six-million-dollar building month for Los Angeles, practically bringing this year's total abreast of last year's while San Francisco and Oakland are about 70 per cent ahead, being aided by exposition buildings and bridge approaches.

Government purchasing of supplies is brisk in all departments, but particularly for navy fields and yards. Federal construction is attaining another peak, including a seven-million-dollar postoffice and courthouse for Los Angeles and a $500,000 Capitol for Alaska, bids for both of which are to be opened in September, besides $2,000,000 of additional navy barracks and a $300,000 new hospital unit for San Diego. This activity and the prosperity it engenders have resulted in new yearly and all-time kilowatt demand highs by the power companies.

Mining is an example of the way in which modern conditions and trends increase load possibilities, because the rehabilitation of abandoned mines requires pumping, the deepening of exhausted mines necessitates air conditioning and the conversion of steam or oil-driven plants calls for a 3- or 4-mile extension to furnish 1,000 to 2,000 hp. Retail business continues excellent, with electrical appliances participating in the activity.

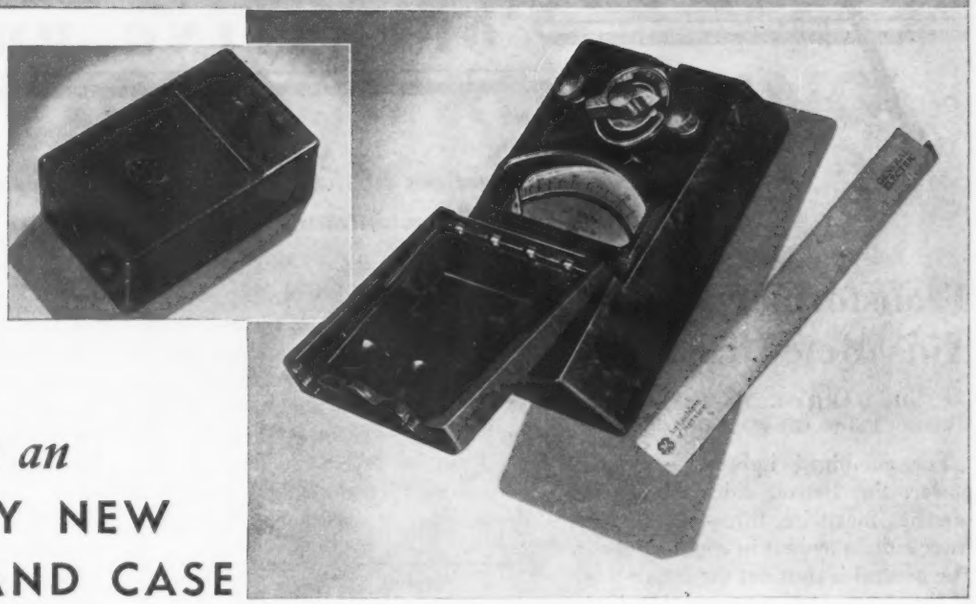
CHICAGO

Last week's statistics showed industrial activity had not only resisted decline but advanced for the tenth consecutive week. A decline is still anticipated, however, and a tapering-off in business activity during the next few weeks will not come as a surprise. In spite of such disturbing factors as the drought and political uncertainties, the underlying stability that has characterized the advance so far is cause to expect even greater activity this fall. Freight car loadings have reached the highest peak since 1930 and the high rate of operations maintained by the steel mills in this area is a most reassuring factor in the business outlook.

Erection of a complete windowless commercial and industrial building will require extensive use of electrical equipment. Lighting will be a prominent feature in this structure, which will be completely air conditioned. Other air-conditioning installations contracted for last week include a department store and several smaller shops. Construction of two theaters and remodeling of two others has brought some nice orders for electrical equipment.

Lighting equipment manufacturers report a steady improvement in sales. The trend of modernizing stores and offices has resulted in a substantial gain in fixture sales along with an increase in wattage in the new installations. The increasing popularity of night sport events is proving beneficial.

NEW POCKET-SIZE INSTRUMENT



With an ENTIRELY NEW ELEMENT AND CASE

NEW—inside and out—is this AS-5 pocket-size instrument. Its element and case are entirely different and have been redesigned throughout.

Dependable operation has been given first consideration. High torque, lightweight moving parts, large clearances, all combine to give excellent sustained accuracy—an accuracy which is within one per cent of full-scale value.

The vital parts of the element, such as magnet supports, jewel-supporting plates, and separating studs, are made of tempered brass. The sturdy construction of these details gives perfect spacing under the severest service conditions. The AS-5 will always give dependable, trouble-free performance.

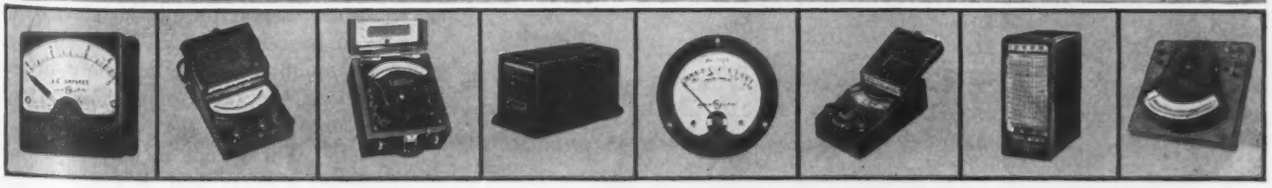
Magnetic damping and quick-response features save you time in taking readings. The clearances are large enough so that stickiness is practically impossible.

The new case is of tough Textolite. It's thicker, with ribbed reinforcements, and will stand the roughest usage. When the cover is closed, glass, scale, and binding posts are protected.

Undoubtedly you are familiar with the well-known AP-9 instruments. These AS-5's resemble them; they will give you the same fine service; and their size, 2 by 3½ by 5½ inches, is ideal for testing work.

There are AS-5 a-c voltmeters, ammeters, and milliammeters for all ranges. Write today for a copy of GEA-1784A. Address your nearest G-E sales office, or Dept. 6E-201, General Electric, Schenectady, N. Y.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT



Rectangular switchboard | Medium-size portable | High-accuracy portable | Galvanometer | Small panel | Pocket portable | Recording | Laboratory standard

430-67

GENERAL ELECTRIC

Field OPERATING PRACTICES

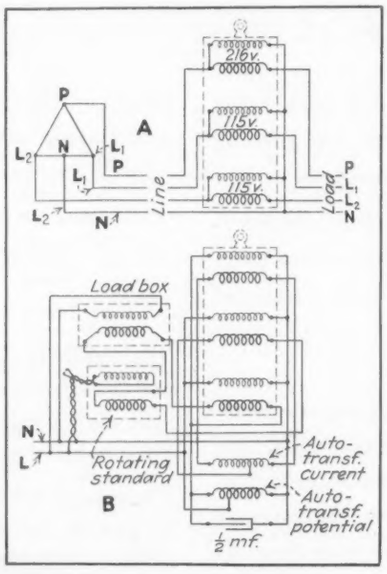
New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

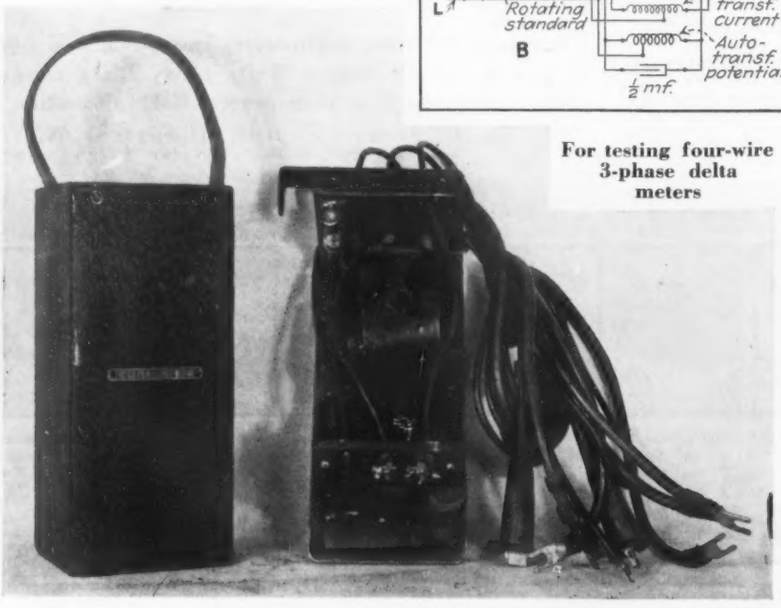
Transformer Scheme Aids Meter Testing

By HARRY G. HAMMOND
Detroit Edison Company, Detroit, Mich.

For combined lighting and small power, the Detroit Edison Company supplies four-wire, three-phase service from a delta system in some localities. The neutral is thus not the center point of the three-phase diagram, but is the middle of one of the sides of the delta. This type of service is metered with a three-element meter. Two of the elements correspond to the usual single-phase, three-wire instrument. The third element current coil is in series in the power phase wire and its potential coil is connected between this wire and the lighting neutral at the center of the opposite side of the delta. Meter connections are shown at "A" in the accompanying sketch.

Common practice for artificial load testing of three-wire, three-phase and three-wire, single-phase meters on customers' premises is to connect current coils in series, potential coils in parallel and test the whole meter as one single-phase element. Obviously this could not be done with the four-wire, three-phase meter without some kind of special compensation, because the third element is designed for potential 73 per cent higher than that of the other two elements and for current 42 per cent lower. A means had to be provided to multiply the test potential by 1.732 and divide the test current by the same factor for the third element. A pair of auto-transformers looked like a reasonable solution. The accompanying illustration shows them assembled with a ½-mfd. condenser to correct phase error ready for insertion into the carrying case and the diagram "B" shows the test connections.





For testing four-wire 3-phase delta meters

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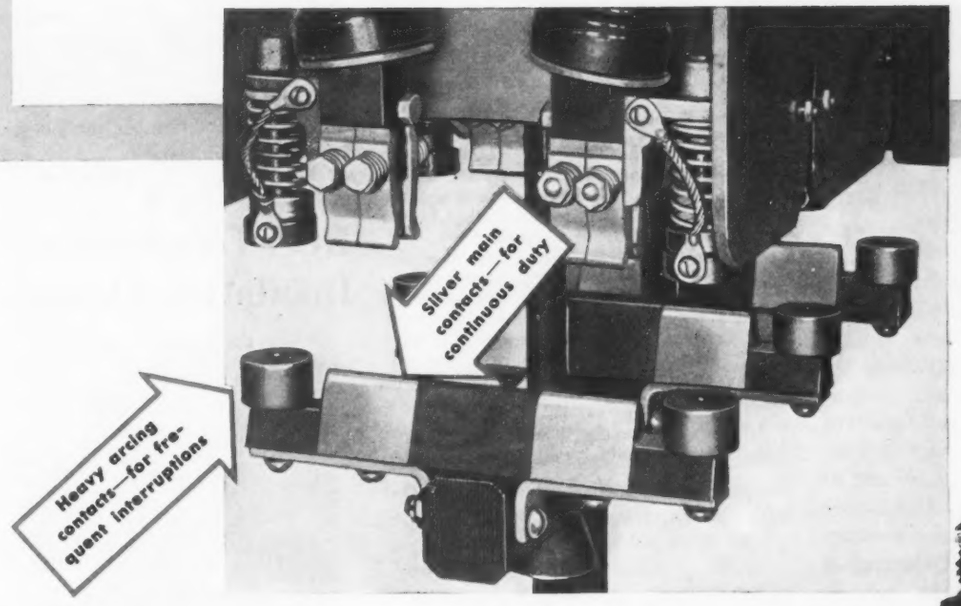
Oil Storage System Saves Money

By GERARD VELLEMAN
Engineering Department,
Toledo Edison Company, Toledo, Ohio

About a year ago the Toledo Edison Company installed a system for reconditioning old transformer oil and for salvaging oil that formerly had been thrown away because of its high percentage of sludge. The installation, consisting of storage tanks, processing tank, settling tanks, service tank, pumps, filter press, separator and an interconnected system of piping to permit the transfer of oil from one tank to another, has replaced the storage of oil in barrels and has saved substantial amounts for the company in the handling and reuse of old oil. Until the completion of the new oil storage system oil was kept in barrels, which took up a great deal of space in the transformer department. Old oil with sludge in it had to be thrown away and the floor was always covered with a thick layer unavoidably spilled in handling. Now the new oil, received in barrels, is sent through a filter press to

MADE TO "STAND THE GAFF" OF AUTOMATIC RECLOSING



The FKO-227... A NEW OUTDOOR OIL-BLAST BREAKER...

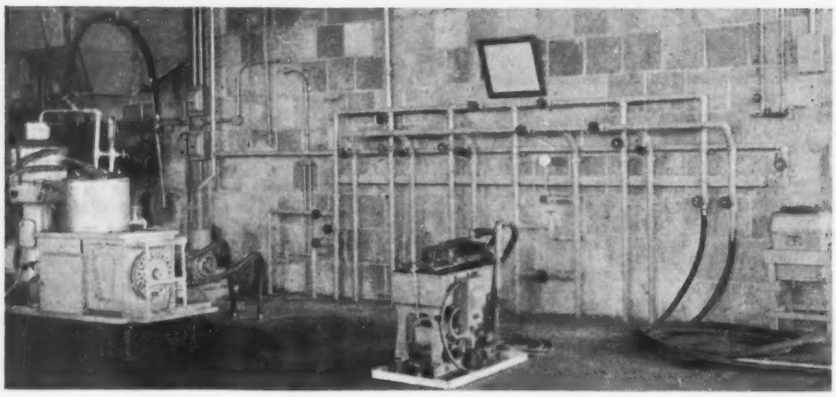
A STRONGER breaker that will withstand thousands of repeated openings and closings. —Contact construction proved in earlier G-E breakers for heavy-duty service. —The *oil-blast* principle of operation to clear short circuits quickly and surely, the same principle so successfully used in G-E breakers rated fifty times greater. —Unusually strong operating mechanism; small space requirements; and simple construction for easy installation, particularly on a pole, and for easy inspection.

Install the 227 in your distribution lines for automatic reclosing and keep your electric-service outages to the minimum. It is rated 50,000 kva, up to 7500 volts. More information on request. General Electric Company, Schenectady, New York.

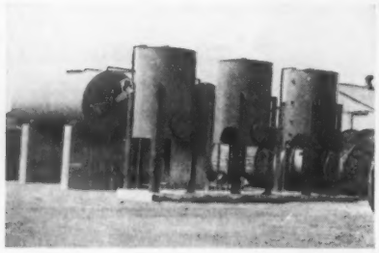
Framework mounted. Bolt the structure in place and connect the leads. (Also available for pole mounting)

890-5

GENERAL ELECTRIC



Filter press and separator are connected through flexible hose to outlet in building floor



Oil storage tanks are located outside building

storage in a 2,000-gal. tank outside the transformer building.

Transformers taken in for repair or inspection are emptied of oil with a rotary pump which brings it to one of two 550-gal. settling tanks. Here, after a two or three weeks' period, the water and sludge are drawn off through a 2-in. gate valve in the tank bottom. The oil remaining is then pumped through a separator and a filter press to another 550-gal. processing tank, where it is tested and, if found satisfactory, is sent to storage in a 2,000-gal. storage tank. If found not up to test the oil is recirculated through the filter press.

The five tanks are all located outside the building. Whenever oil is needed, whether new or reconditioned, it can be pumped directly into the transformer from the main storage reservoirs or drawn by gravity from a 280-gal. house tank.

All valves inside the building, except those through which oil is being pumped, are normally kept closed. To guard against excessive pressure caused by a closed valve, pumps are provided with a pressure release valve set for 25 lb. Normal operating pressure is about 7 lb., of which more than half is caused by the static head of the oil in the piping.

To allow the use of different sizes of equipment without necessitating any changes in piping, filter press and separator are connected through flexible hose to outlets in the floor. This flexible type of connection, combined with the low operating pressure of the system, has eliminated leaks and the hazards arising from them.

In its first winter's operation, and notwithstanding extreme weather conditions, no difficulties were experienced with the handling of the oil.

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Ground Fault Lamps Used for Signaling

By **FRED CLAYTON**
Nashville, Tenn.

Lamps installed in the conventional way for ground detection have been used successfully as a means for signaling from and to operators in the cabs of monorail cars in a lumberyard. A switch for momentarily grounding the same one line wire of the two-wire, 220-volt, d.c. supply system was installed in each cab and at several other points. Fuses, of course, protected against short circuits in case the other line was accidentally grounded.

Closing and opening the switch in accordance with a code made all lamps blink and thus pass the signal over the system, a mile or so in length. The person called can, of course, acknowledge the signal by the same procedure. This simple scheme avoided the expense of a telephone system and the inconvenience of climbing down 15 to 25 ft. from the cabs to answer a call. Some of the ground lamps were placed inside the cab for the information of the operator and the rest were placed outside so that trouble men could also receive the signals.

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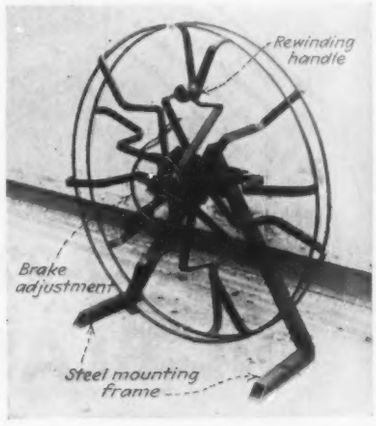
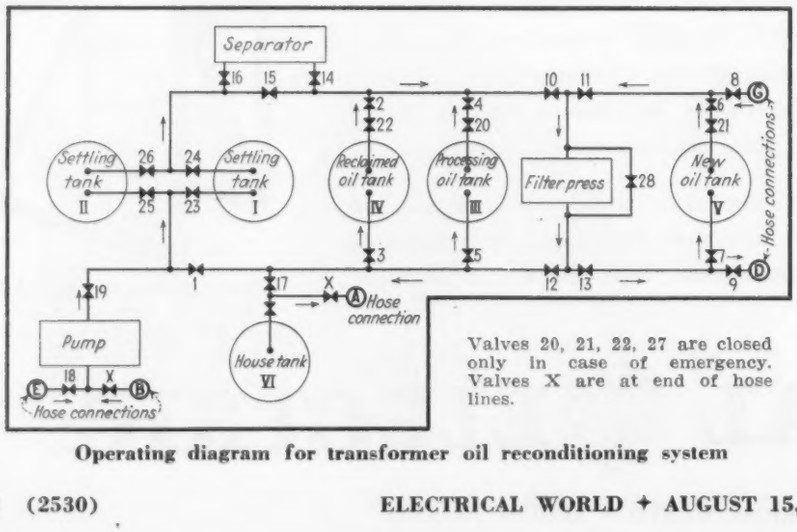
Reel Eliminates Insulation Damage

By **CARL R. WENZ**
Assistant Superintendent of Construction,
Oklahoma Gas & Electric Company



Service wire now unwound, not uncoiled

To protect the insulation of service wire during installation a new service wire reel is being used by the Oklahoma Gas & Electric Company which eliminates the characteristic twisting or corkscrew effect when wire is being uncoiled. It also speeds service-wire installation. This reel consists of a metal framework mounted on a steel-tube base and has an adjustable friction brake which allows the proper tension to be maintained as the wire is being unwound. A handle permits rewinding wire. Wire manufacturers furnish coils with inside diameter to fit this reel.



Operating diagram for transformer oil reconditioning system

Power AT WORK IN INDUSTRY

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Annealing Reduces Glass Breakage

Prior to the installation of a specially designed, electrically heated furnace for annealing watch crystals the Acme Watch Crystal Manufacturing Company, New York City, experienced considerable difficulty with breakage after the crystals had been shipped to customers.

Electric furnace anneals watch crystals to reduce breakage

The new furnace, by relieving internal stresses in the glass, has practically eliminated breakage from this cause. Cylindrical in design, the furnace is provided with a heated well 12 in. in diameter x 12 in. high. Into this well a monel metal tripod with three shelves is lowered with a charge of crystals to be annealed. Crystals are placed in the furnace cold and are brought up to a temperature of between 800 and 900 deg. F. in two hours time. At the end of the heating-up period current is automatically disconnected and the charge cooled over a period of eighteen hours.

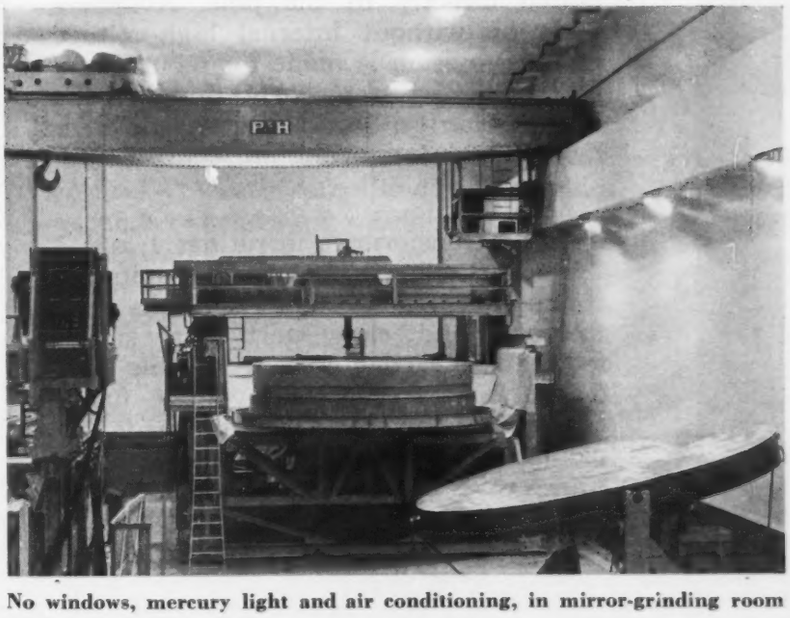
Designed and manufactured by the Gruenberg Electric Company, New York City, the furnace is rated at 3 kw., 240 volts. Heating elements consist of chrome-steel-clad strip heaters evenly distributed and strapped around the outside surface of the steel chamber. A three-heat switch and thermostatic heat control provide the necessary temperature regulation. The thermostat may be set to open the circuit at any temperature up to 1,000 deg. F. Once the circuit is opened it must be closed manually. The furnace is supplied with electric service by the New York Edison Company, Inc.

A larger furnace of similar design rated at 6 kw. was recently installed at the Rockefeller Institute of Medicinal Research, New York City, for annealing glass specialties.

Mazda-Mercury Light for Mirror Grinding

Windowless air conditioning and ideal lighting are demanded for the exacting room in the astrophysical optical shop of the California Institute of Technology, where the four-year job of grinding the 200-in. telescope mirror has been started. Color striations or fringes must be avoided by careful distribution and color balance. Two-degree temperature control, a 60-ton crane and a 30-ft. ceiling complicated the lighting of this 56x175-ft. room.

The installation embraces twenty 1,000-watt incandescents mounted above special glass panels to keep their heat out of the room. Sixteen Cooper-Hewitt mercury lamps are mounted at 20-ft. spacing on the side walls beneath the craneways, with their auxiliaries outside. The lamps themselves are cool and require no heat filters.

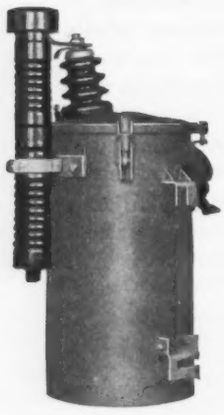


No windows, mercury light and air conditioning, in mirror-grinding room

A COMPLETE LINE OF G-E PRODUCTS

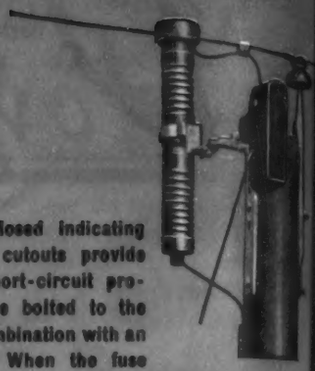
G-E Type H distribution transformers will provide the highest standard of service and the greatest flexibility in application. They have high insulation strength and excellent voltage regulation. Exacting design and construction and excellent operating records assure long service and low operating cost. The maximum degree of service continuity can be obtained by the use of these Type H transformers installed with G-E pellet arresters (using interconnection) and G-E enclosed and indicating cutouts. For complete information ask for Bulletins GEA-2084A, GEA-2362, and GEA-93J.

If preferred, there is available the Type HA transformer in which Thyrite valve-type arresters are built integral with the high-voltage bushings. The arrester grounds can be connected internally directly to the secondary neutral or to the tank, which in turn can be connected to ground and to the secondary neutral, either direct or through an isolating gap, as desired. Ask for GEA-2077A.

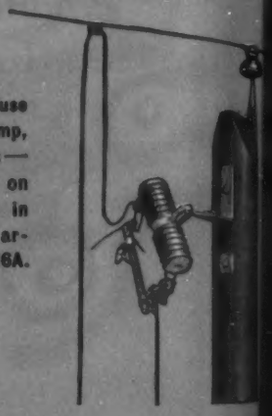


Type H transformers for rural-line service are particularly adapted for installation on solidly grounded common-neutral rural circuits, 7620 volts line-to-ground and below. They offer the same low losses and good voltage regulation as does the Type H—and they can be bolted directly to the pole. Available with or without internal high-voltage fuses. Provision is made for mounting a G-E pellet arrester on the tank; or the arrester can be bolted to the pole. Ask for GEA-2421.

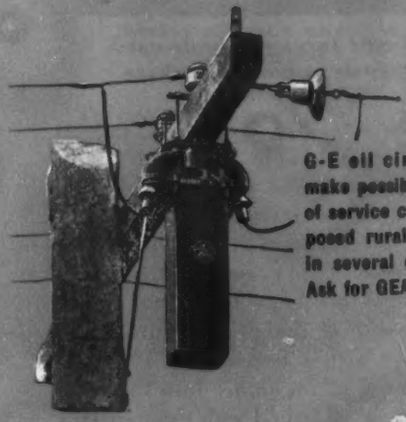
Type R transformers in ratings 1 and 3 kva are simplified, inexpensive units for common-neutral circuits 7620 volts line-to-ground and below—particularly suited for sparsely settled areas. Available with or without internal high-voltage fuses. If specified, provision can be made for mounting a G-E pellet arrester on the transformer tank; or the arrester can be bolted to the pole. Ask for GEA-2206A.



G-E porcelain-enclosed indicating and drop-out fuse cutouts provide easily renewable short-circuit protection. They can be bolted to the pole alone, or in combination with an arrester as shown. When the fuse blows, they give visible indication by either complete or partial opening of the door. Rating: 50 amp, 7500/12,500 gr-Y volts. Ask for GEA-1993C.



G-E open-type drop-out fuse cutouts — rated 60 amp, 7500/12,500 gr-Y volts — can be mounted directly on the pole as shown, or in combination with the arrester. Ask for GEA-1816A.



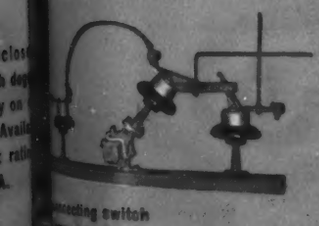
G-E oil circuit reclosers make possible a high degree of service continuity on exposed rural lines. Available in several different ratings. Ask for GEA-2003A.

TO MAKE RURAL EXPANSION PROFITABL

The 30-amp line-suspension fuse cutout is especially suited for rural application on "one-line" common-neutral circuits, 8,000/13,800 gr-Y volts and below. The cutout clamps to the line "saddle," which is bolted to the line conductor, preventing burning of the line. Available with or without lower terminal and indicator. Ask for GEA-2328.

The new 30-amp G-E hot-line-clamp suspension fuse cutout provides, at minimum cost, a high degree of protection for "one-line" common-neutral circuits, 8,000/13,800 gr-Y volts and below. The head of the cutout consists of a hot-line clamp, with an opening that permits its use on conductors as small as No. 6 solid copper or as large as No. 2 A.C.S.R.—over the armor rod. Available with or without lower terminal and indicator. Ask for complete information.

Secondary fuse cutouts provide a high degree of protection where minimum-size fuse links used in the primary cutout are too large to protect the transformer from secondary faults. They can be mounted on hard-drawn copper angles, clamped to the transformer low-voltage terminals. They give visible indication when the fuse blows. Ratings: 100 amp, 250 volts. Ask for GEA-2261B.

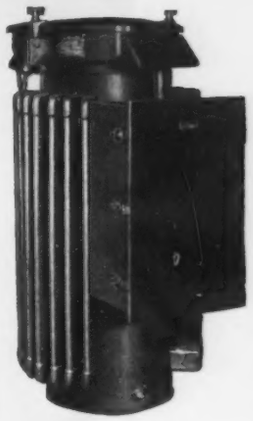


Disconnecting switch (group operated)

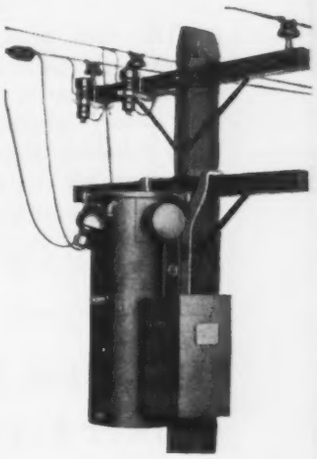
Drop-out fuse disconnecting switch

Disconnecting switches and drop-out fuse switches with long switch life, permanently easy operation, low resistance, and savings in the cost of rural lines. Ask for complete information.

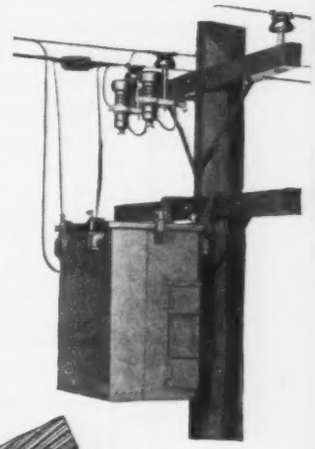
The G-E branch-feeder induction regulator provides smooth, efficient automatic regulation for branch and rural circuits—2400 or 4800 volts. It is suitable for either crossarm or platform installation. Standard sizes are 12 to 24 kva. Ask for GEA-2018B.



Small size and low cost make the G-E branch-feeder four-step regulator particularly applicable to 2400-, 4800-, and 6900-volt branch and rural circuits which, from a service and economical viewpoint, do not justify the smoother regulation afforded by the induction types. It is easily and inexpensively installed, and will give thoroughly reliable service. Standard sizes are 5 to 50 kva. Ask for GEA-2038B.



The G-E branch-feeder booster provides automatic voltage correction by means of a single, definite change in feeder voltage where required by periodic heavy demands. In addition, a permanent change in voltage can be effected. Its low cost makes it applicable for 2400-, 4800-, and 6900-volt single-phase rural circuits where higher-priced regulators could not be seriously considered. Standard sizes are 5 to 50 kva. Ask for GEA-2036B.



Type SS rural cable is self-supporting, insulated, aerial cable. It provides lower-cost installation and maintenance. GEA-2408. DC weatherproof line wire provides a higher degree of insulating qualities than is found in ordinary weatherproof wire. GEA-2103. Type R, for underground installations, affords lower installed cost in many cases, and lower maintenance, because of immunity to storms and other hazards. GEA-2216.

General Electric, Schenectady, N. Y.

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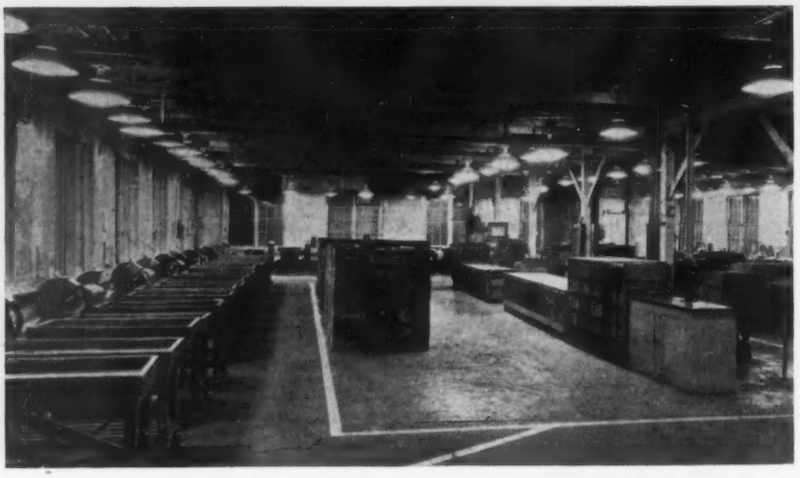
E L E C T R I C

Combination Units Improve Factory Light



This view of the finishing department of the General Electric Hotpoint plant at Ontario, Calif., typifies modern factory lighting. Above the buffing and polishing wheels on three sides of the room are mounted "Glassteel" diffusers on approximately 4-ft. centers, the lighting units consisting alternately of a 500-watt Mazda lamp with a 400-watt, high-intensity mercury-vapor lamp. Fifty foot-candles are provided at the machines and a combination of Mazda and high-intensity mercury-vapor lamps provide a quality of light excellently suited for machine tool work without fatigue. In the center of the room a similar installation provides 50 foot-candles on the tables.

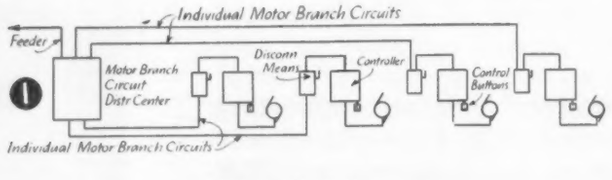
Hints for Making a Power Feeder Layout

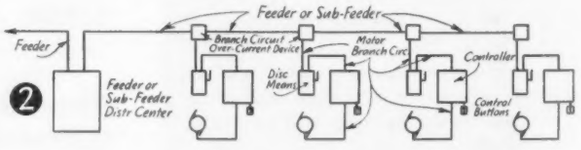
Varying factors in power feeder design, such as routing, grouping of motors and voltage loss, affect the design and layout of power circuits for commercial buildings and industrial plants. Five layouts commonly used and based on official industry standards and accepted good practice as summarized in the Master Specifications published by *Electrical Contracting*, June, 1936, are illustrated herein.

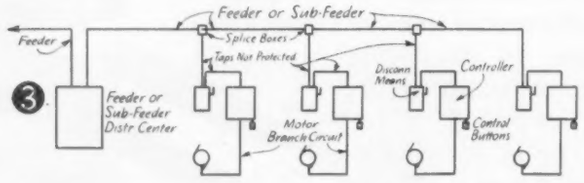
Referring to the accompanying illustrations: type (1) is the most commonly used and can be employed under any condition. It is the preferred type for supplying miscellaneous power loads in commercial buildings and industrial plants. Use of types (2), (3) and (4) is limited to plants where a larger number of small motors are used to drive individual machines. Unlike type (2), type (3) requires no branch-circuit overcurrent device but conductors from the sub-feeder to the controller must be larger than in type (2). If the sub-feeder can be brought directly to each controller, type (4) will show an economy in cost over either type (2) or (3). Type (5) is merely a means of providing for small motors used with household and commercial appliances by permitting them to be connected to lighting or appliance branch circuits.

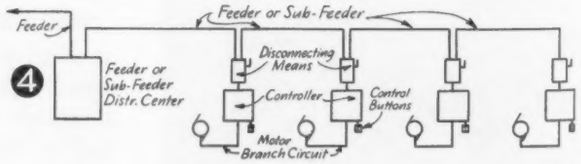
All conductors in these circuits must have sufficient carrying capacity, according to the National Electrical Code requirements, and should also be of such size that total voltage drop to any motor will not exceed 5 per cent. On any system operating on 208 volts or higher, it is recommended that the voltage drop in motor branch circuits should not exceed 1 per cent, in which case a drop of 4 per cent in feeders is allowable. In cases where the drop will exceed 3 per cent, the annual cost of kilowatt-hours consumed in copper losses should be computed and consideration given to use of larger conductors to reduce loss.

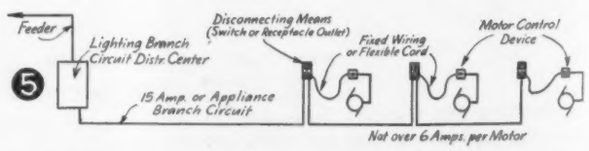
In an industrial plant it is almost always best to install service and feeder conductors of larger sizes than are required for initial load. Besides providing for load increases excess size will also reduce copper loss.










Feeder
Disconnecting Means (Switch or Receptacle Outlet)
Motor Control Device
Lighting Branch Circuit Distr. Center
Fixed Wiring or Flexible Cord
5
15 Amp. or Appliance Branch Circuit
Not over 6 Amps. per Motor

(1) A separate circuit run to each motor from a branch-circuit distribution center.
(2) A feeder or sub-feeder carried around the building with branch circuits tapped to the feeder at various points, no branch circuit distribution center used.
(3) A feeder or sub-feeder with sub-feeder taps, having no individual over-current protection, carried direct to the disconnecting means or controller for each motor.
(4) A feeder or sub-feeder direct to the disconnecting means or controller for each one of the group of motors. Otherwise the layout is the same as in (3).

(5) A group of small motors, each having a full-load current rating not exceeding 6 amp., supplied by a 15-amp. branch circuit or an appliance circuit.

Commonly used power circuit layouts for industrial plants

ELECTRIFIED BREWERIES (5)

The Brewing Process (Continued)

5. *Hop Storage*—Hops are stored at 31° F. in dry room, using direct expansion ammonia coils (or brine coils).
6. *Hop Jack*—The wort passes from the brew kettle to the hop jack, where the spent hops are strained out. A pump thence delivers the wort to a temporary tank of about 200° F.
   Wort Pump Rating—Depends on volumes and heads resulting from plant layout.
   Mfrs.—2, 9, 15, 16, 21, 24, 28, 30, 32, 33, 35, 38, 40, 46, 50, 55, 58, 72, 73, 74, 77, 82, 85, 87, 91, 95, 96 (see sheet No. 24).
7. *Wort Cooler*—The wort (sp.ht. 0.9) is run either (1) over open (Baudelot) cooler or (2) through closed cooler and cooled to 70° F. or lower in the water section, followed by cooling to 45-50° F. in the ammonia section. Ordinarily one ton of refrigeration in 24 hours should cool 40 bbl. or more of wort from 70°-50° F. Two hours is usual time. The liquid is now lager and right for addition of yeast at fermentation tanks. It is passed, first, to open settling tanks for 24 hours at 38-40° F., thence to fermentation cellar.
   Wort Cooler Mfrs.—7, 17, 21, 38, 41, 42, 43, 52, 76, 77, 82, 90, 95 (see Sheet No. 24).
8. *Fermentation*—The lager is next fermented 8-11 days in wooden or glass-lined steel tanks equipped with cooling coils (attemporators) to prevent rise in temperature from about 45° F. from heat generated as fermentation promoted by yeast progresses. Maltose ($C_{12}H_{22}O_{11}H_2O$) changes to alcohol ($4C_2H_5OH$) and carbon dioxide ($4CO_2$). About 280 B.t.u. is generated per pound of maltose and, in general, it requires 1 ton of refrigeration for 40-60 bbl., of maltose per day to remove the heat, the higher values applying to lower "balling" (percentage of extract). Brine circulation is general, cold water circulation occasional. The CO_2 is pumped through purifier into compression tanks for use in subsequent recarbonification of the beer.
   Attemperator Ratings—One ton of refrigeration for 50 bbl. capacity.
   Mfrs.—20, 21, 41, 43, 88, 93, 95 (see Sheet No. 24).
9. *Cooling*—On completion of fermentation, the beer is cooled to 34° F. in brine or ammonia cooler and thence to storage cellar.
   Refrigeration Mfrs.—7, 11, 18, 21, 22, 31, 37, 38, 43, 44, 47, 55, 59, 88, 89 (see Sheet No. 24).
10. *Storage*—The beer passes from the cooler into cellar storage tanks, where it ages for 1 to 3 months at even temperature of about 34° F. in insulated rooms. In the Nathan Process the storage is greatly reduced (or even eliminated entirely) (see Sheet No. 26).

Finishing Process

11. *Carbonic Compressor*—The CO_2 gas released by fermentation has, meanwhile, been purified and compressed for storage and subsequent use in the carbonator-filter. Breweries not using closed-tank fermentation buy their CO_2 in cylinders.
    Compressor Rating—For 100-bbl. brew, a 5-hp. (squirrel-cage) motor is usually used.
    Mfrs.—21, 33, 77, 91, 94 (see Sheet No. 24).
12. *Carbonator-Filter*—After aging, the beer is pumped through a double-pipe ammonia cooler (32-33° F.) to the carbonator-filter. The CO_2 is there reinjected into the beer and then it passes through the filter and acquires "sparkle." It is now ready for racking into kegs or tax-measurement and bottling or canning.
    Carbonator Filter Mfrs.—3, 14, 16, 29, 33, 65, 70, 77, 82, 94.
    Beer Pump Rating—Motors 1½ to 15 hp. (squirrel cage).
    Mfrs.—See Wort Pumps (6).

ELECTRIFIED BREWERIES (6)

Finishing Process (Continued)

13. *Keg Racker*—Cleaned kegs are filled with air or CO_2 to above atmosphere pressure to prevent foaming as the beer runs into them from the racking machine in a room at 34-36° F.
    Keg Rack Pump Rating—Squirrel-cage motors 1½-15 hp., about 5 hp. for 100-bbl./hr.
    Mfrs.—38, 69, 77, 95 (see Sheet No. 24).
14. *Bottling or Canning*—Beer for bottling is drawn from metered government tanks (34° F.) into the automatic bottling or canning machine.
    Bottle Filler—Squirrel-cage motor ¼-½ hp.
    Mfrs.—16, 28, 29, 38, 58, 65, 66, 70, 71, 84, 96 (see Sheet No. 24).
15. *Pasteurizer*—Filled bottles are pasteurized at 140° F. for 35 minutes (pint bottles) or 45 minutes (quart bottles) with over-all cycle of 60-70 minutes in the steam-heated pasteurizer. On account of the better conductivity of metal, the time for pasteurization of canned beer is much shorter.
    Pasteurizer Ratings—Squirrel-cage motors of 1-15 hp.
    Mfrs.—12, 26, 34, 36, 65, 71 (see Sheet No. 24).

Nathan Process of Closed Brewing

The Nathan Institute, Inc., process (20 years standing) substitutes for the above processes from wort-cooling through storage, an aseptic handling which shortens the aging period to a matter of one or two days. The open Baudelot coolers are in closed observation-window compartments supplied with conditioned air; bacteriological infection is minimized at this precarious stage in beer making. Clarifiers are closed and sterilized. Fermenters are closed, with dome tops and refrigerated conical bottoms. Evolved CO_2 during 8-10-day fermentation is collected and purified for later use. A one- to two-day maturation follows removal of yeast which settles at conical bottoms of fermenters; a finely divided stream of CO_2 washes out "young substances," removing constituents responsible for harsh odor and tastes of green beer. Final carbonization takes about 12 hours, followed by filtering and bottling. Pasteurization is omitted. (See article on Hoffman Beverage Co. plant, Newark, N. J., in *Food Industries*, July, 1935.)

Keg Handling

16. Empty kegs are repaired if necessary. A portable welder is useful for repairing hoops and for other piping and tank jobs. Kegs are scrubbed inside and outside.
    Welder Mfrs.—1, 47, 45, 61, 62, 83, 89 (see Sheet No. 24).
    Keg Washer—Requires ⅛-5-hp. squirrel-cage motor.
    Mfrs.—10, 39, 48, 63, 71, 75, 76, 77, 95 (see Sheet No. 24).
    Repitcher—Electrically heated pot of appropriate capacity can be substituted for gas in heating pitch.
    Mfrs.—38, 39, 53, 69, 75, 76, 95 (see Sheet No. 24).
    Keg Elevator—Requires about ¾-hp. motor.

Bottling Plant

17. Bottles are washed and conveyed to the bottle filler and thence to the crowner and into the pasteurizer. They are next labeled and then put into cases on the case conveyor for storage or delivery.
    Bottle Washer—Requires ¼-3-hp. motor.
    Mfrs.—12, 26, 34, 36, 38, 65, 69, 70, 71, 84, 96 (see Sheet No. 24).
    Bottle Crowner—Requires ¼-2-hp. motor.
    Mfrs.—16, 28, 29, 65, 70, 71, 84 (see Sheet No. 24).
    Bottle Labeler—Requires ⅛-½-hp. motor.
    Mfrs.—8, 28, 65, 66, 84 (see Sheet No. 24).
    Conveyor Mfrs.—5, 6, 13, 17, 23, 25, 26, 45, 48, 53, 56, 57, 58, 60, 63, 67, 68, 71, 78, 79, 80, 84, 86, 92 (see Sheet No. 24).

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

"Entoleter" by Corona Kills Cereal Insects

By L. B. HADDAD
Products Protection Corporation,
New Haven, Conn.

Corona, bugbear of dielectric engineers, is put to practical use in the Entoleter to give millers protection against infestation of their products by insects. It is applied in two forms: (1) In the grain stream between elevators and the first break roll, and (2) for packaged cereal between the top sealer and the tight wrapper.

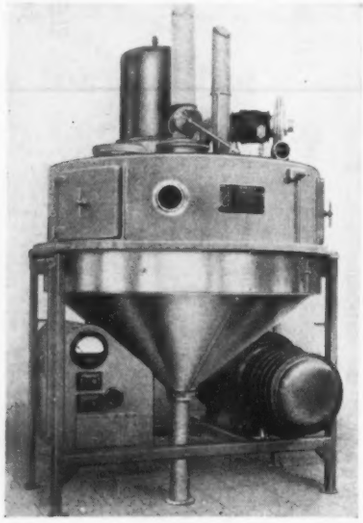
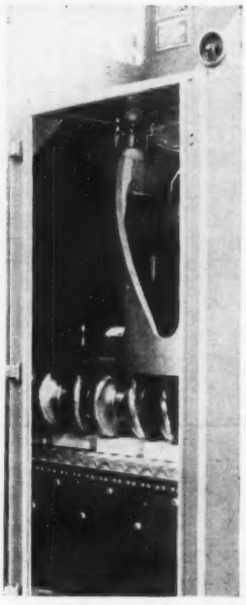


Fig. 1—Grain passed in thin layer through zone of high frequency, high voltage

A 7½-hp. motor takes power from the commercial line and drives a 500-cycle, 220-volt, 5.0-kva. alternator. The voltage from the alternator is impressed on a 500-cycle, 220 to 22,000-volt gas-insulated auto-transformer. To control voltage regulation and to compensate for effects of frequency fluctuations arising at source of supply in some localities a specially designed filter circuit is interposed between the alternator and the transformer. The high-tension terminal of the transformer is connected to a metal electrode which makes contact with metallized portion of the surface of glass plate. Grounded side of transformer connects to rotating metal electrode, which receives the grain near its center and propels it centrifugally into the treatment zone, where it is bombarded by corona and then falls into the grain hopper.



The high-voltage terminal of the transformer is connected to metal electrodes rotating at 3,500 r.p.m. Underneath are placed "Pyrex" glass rollers containing cylindrical metal electrodes. Each of these electrodes is connected to the high-voltage side of an air dielectric condenser which is grounded on the other side. One terminal of the transformer is also grounded. Thus the corona current flows from the top electrodes through the treated material by ionization of the air, then to the electrodes of the glass rollers, and through the air condensers to ground by means of capacity displacement currents.

Fig. 2—Packaged cereal insect-proofed by corona

The mill stream Entoleter (Fig. 1) destroys all insect life that can reproduce in ground stocks, including eggs, larvæ, pupæ or adults. A single unit will handle 400 bushels of spring wheat per hour and has a power consumption of 7½ kw.

The package Entoleter (Fig. 2) insures indefinite freedom from any form of insect life provided the packages are properly sealed to prevent reinfestation. A standard installation includes a 7½-hp. motor driving a 1,000-cycle, 220-volt, 5-kva. alternator, a filter circuit and a 1,000-cycle, 220/120,000-volt auto-transformer. Packages are conveyed through the treatment zone by glass rollers driven by motor and belt. Rate of treatment varies between 30 and 60 cartons per minute. Total power consumption is 7½ kw.

Since the products are treated at normal temperature, they retain their original moisture content, flavor, food value and appearance.

•

Stroboscopic Scheme Yields Motor Slip

By THOMAS HONAN
New Toronto, Ont., Canada

Occasions frequently arise when it is desirable to determine the slip of induction motors under various conditions. A simple, effective stroboscopic scheme which has proved effective in these cases involves the use of a two- or three-watt neon glow-lamp behind an opaque paper disk of convenient diameter in which an aperture has been cut at one point near the edge. This disk is slipped over a shaft end or wire to the pulley of the machine being studied.

The neon lamp should be connected to a lighting circuit of the same frequency as the motor supply. With the neon lamp mounted so that the lower plate is visible through the aperture in the paper disk and with the motor running at full speed, the lamp will appear to glow and grow dark alternately. Counting the glow periods for one minute gives the slip, which can easily be calculated in per cent of motor speed.

While the bare lamp may be used, a tube of dark paper with a cap on one end having a ½-in. hole in it may be slipped over the lamp to kill reflec-

The Manufacturer's Bulletin Page

KEARNEY
Hi-Line Equipment News

NEW PRODUCT INFORMATION

Advertising News | St. Louis, Mo., August 15, 1936 | World Copy

NEW SECTIONALIZING CUTOUT DEVELOPED—ISOLATES OUTAGES TO RESTRICTED AREAS

Costs, Troubles and Hazards On Series Street Lighting Circuits Materially Reduced

Kearney Series Sectionalizing Cutout Gains Instant Approval After Field Tests Are Made

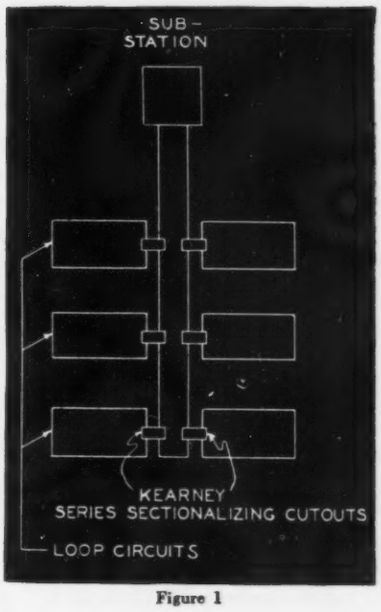
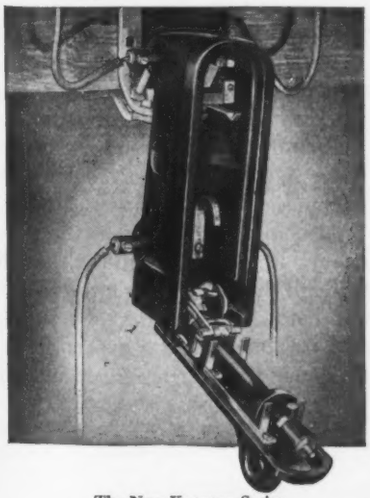


Figure 1

Responding to requests from the field that something be done about isolating outages on street lighting circuits, so that long, tedious patrols would not be necessary in the event of an outage during a storm, the James R. Kearney Corporation has designed and developed a new cutout which reduces costs, troubles and hazards on series street lighting circuits commonly used throughout the United States.



The New Kearney Series Sectionalizing Cutout

The application of the Kearney Series Sectionalizing Cutout to a series circuit is shown by figure 1. Figures 2 and 3 show the principle which governs the operation of the cutout.

Figure 2 shows four stationary contacts, the upper two of which have connected to them the incoming and outgoing leads of the main circuit. Likewise, the incoming and outgoing leads of the loop circuit are connected to the lower contacts. Two switch blades engage the upper and lower contacts on either side to complete the connections from the main circuit to the loop circuit for normal operation. There are connected across the main circuit, in the manner indicated, a gap and fuse link which are in series. The gap is calibrated to break down at a voltage higher than the loop circuit voltage and lower than the open circuit voltage of the constant current transformer. The auxiliary switch, which in its closed position provides a direct connection across the upper main terminals, is restrained in its open position during normal operation.

When an open occurs on the loop circuit, the voltage across the gap immediately increases to open circuit voltage of the constant current transformer. The gap then sparks over, establishing a circuit through the fuse link which blows.

As this happens the switch blades, fuse tube and spark gap assembly are released from the normal operating position, leaving the circuit connections as shown in figure 3. The upper and lower contacts are no longer connected, thus the loop circuit is completely isolated electrically from the main circuit—and further, the auxiliary switch has operated to provide a straight through connection for the main circuit.

If you are interested in greater protection, less hazards and increased savings on your series street lighting operating costs, order a quantity of these new cutouts—install them—then watch the satisfactory results.

FOR INFORMATION AND PRICES
Write **JAMES R. KEARNEY CORP., 4224 Clayton Blvd., St. Louis, Mo.**

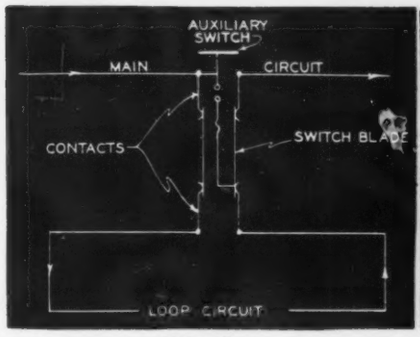


Figure 2

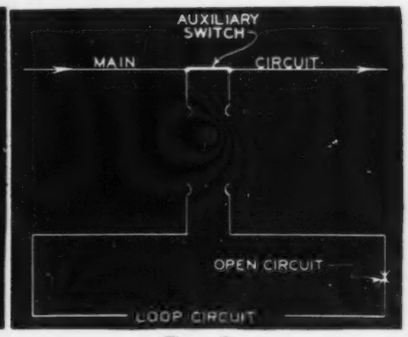


Figure 3

tion from the upper plates of the glow tube, which glowing 180 deg. off may be confusing. With a little calculation this same scheme may be used to find belt slippage.

•

Time-Delay Relay Lets Linemen Sleep

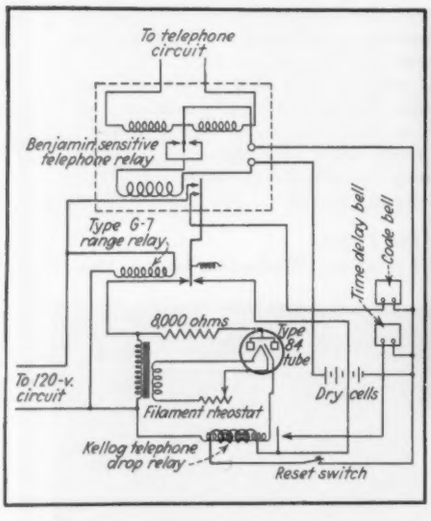
By OWEN W. HURD
Radio Interference Engineer
Northwestern Electric Company

Telephones connecting to the "high-line" telephone circuit used for load dispatching and interstation communication are installed in patrolmen's homes on the Northwestern Electric Company system. The purpose of the phones is primarily to enable the load dispatcher to get in touch with patrolmen for emergency switching or locating high-line trouble in their vicinity.

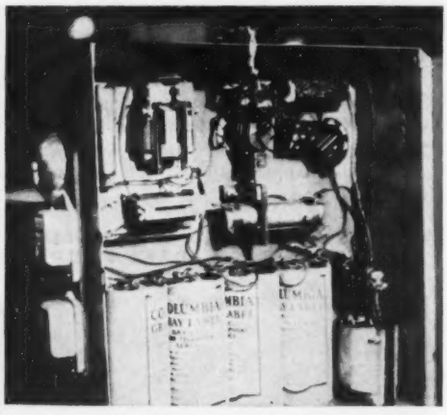
Since this phone circuit has several station phones on it and is used for carrying on routine interstation business, calling is rather frequent and occurs at all hours of the day. Where phones are installed in the homes the continual ringing of the phone bell either becomes an annoyance or is of no value, because the patrolman must hear all calls in order to distinguish his and not miss the calls intended for him.

A very satisfactory time-delay relay has been installed to make it necessary for the patrolman to hear only calls intended for him. If the dispatcher or any one using any connected phone wishes to call the patrolman a ring lasting fifteen seconds is sent out. This rings a bell, which stops ringing only when the patrolman pushes the reset button. This time delay ringing is used after 8 p.m. and until 7 a.m. When the time-delay relay is not connected to the 120-volt light circuit the phone automatically becomes code ringing. Also, if the a.c. power should go off while time-delay relay is being used it automatically switches to code ringing.

All phones having time-delay relays will signal calls intended for any one of these phones, the reason being that only one time interval is used. When it is necessary to call a patrolman at night it is usually necessary to inform the other patrolmen anyway and the system works as an advantage rather than a disadvantage.



When the device is connected to a 120-volt circuit a General Electric type G-7 range relay (to which has been added additional contacts making it a double-throw, single-pole switch) operates, closing a switch in series with the transformer. Now when a signal operates the Benjamin sensitive telephone relay the circuit to the transformer is completed, lighting the filament of the type 84 tube. If the signal continues the heating of the cathode will cause plate current to flow, which will reach such a value in about fifteen seconds as to operate the Kellogg telephone drop relay. The bell will now ring until stopped by momentarily closing the reset switch. Adjustment for time and line voltage is provided for by a filament rheostat. When the device is disconnected from the 120-volt circuit or a power interruption occurs the range relay drops back and the Benjamin relay operates a code-ringing bell.



Time-delay relay installed for use on high-line telephone circuits

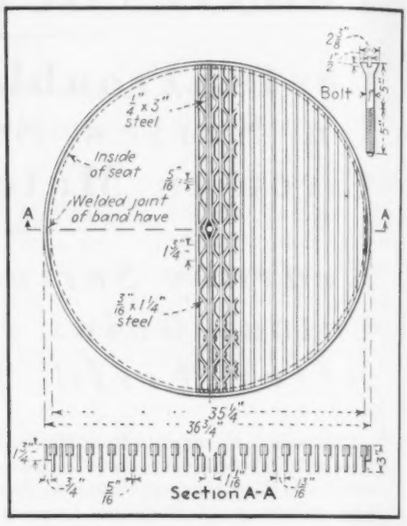
•

Manholes Ventilated by Special Cover

By MERTON HENRY
Brooklyn, N. Y.

A special cover made of flat steel bars is being used in New York City to ventilate manholes in which the cables have been overheated by nearby leaking steam mains, bakery ovens, or other causes. The ventilating cover is left on the manhole for a few days or weeks until the condition causing the overheating is corrected. Then the standard cover is replaced and the special cover held in readiness for use elsewhere. Eight or nine of these special covers are in use most of the time.

The cover is made of $\frac{5}{16}$-in. x 3-ft. steel bars standing on edge $\frac{1}{8}$ in. apart and parallel. This series of rectangular beams is kept from buckling by diagonal side braces formed from a continuous strip $\frac{3}{16}$x1$\frac{1}{4}$ in. riveted to the main bars with $\frac{1}{2}$-in. rivets. A circular band formed from $\frac{1}{4}$x1$\frac{3}{4}$-in. flat steel, to which the ends of the main bars are welded, incloses the interior framework as shown in the illustration. A well-equipped blacksmith shop can make one of these covers for $60 or $70.



Overheated manholes ventilated with open grille cover

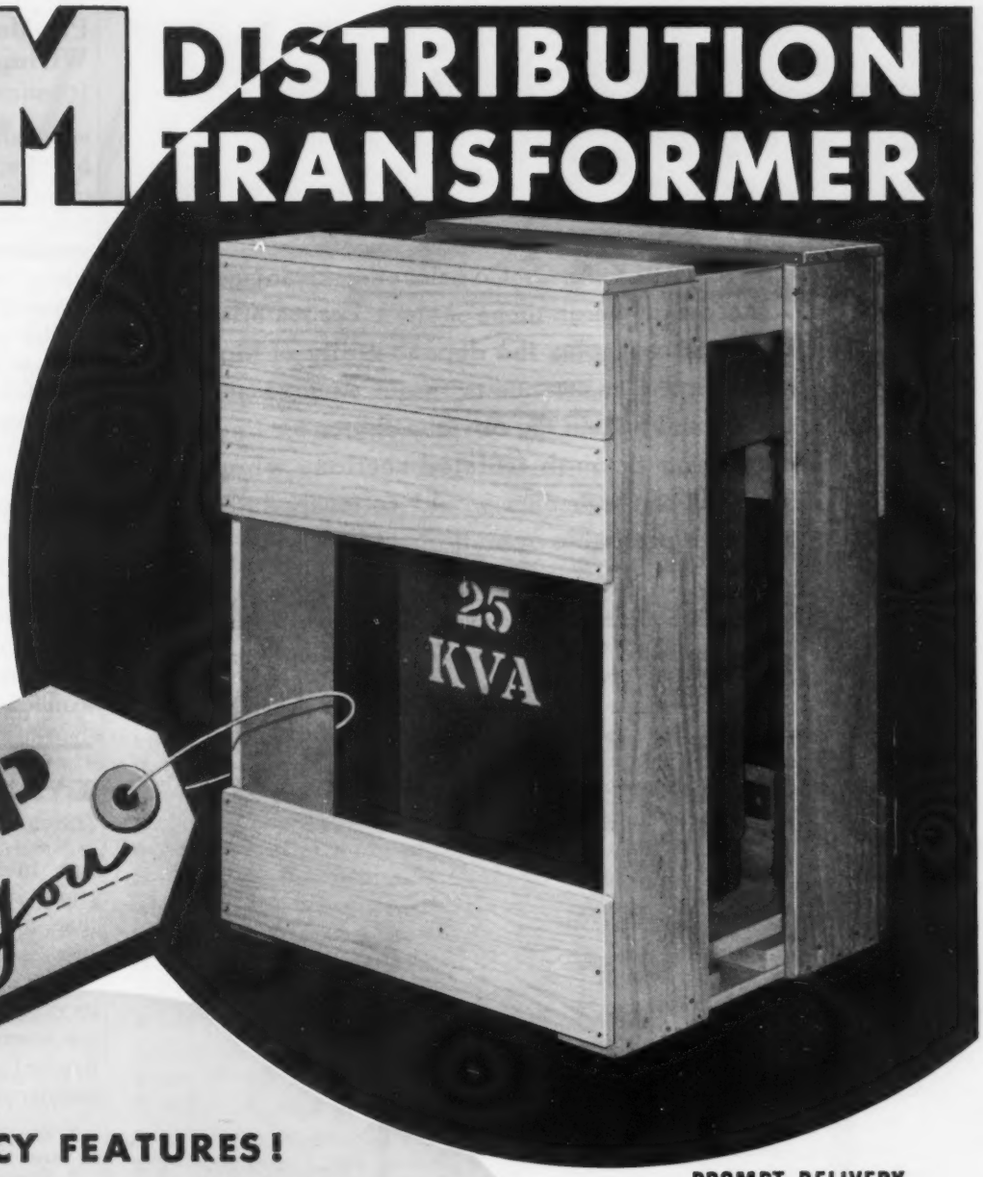
Although the special cover is quite heavy, it is bolted with a 1-in. bolt through the center, engaging the cross-bar below. Properties of a standard cast iron cover and a special cover of the same diameter are given in the following table:

	Standard Cover	Special Cover
Weight, lb.	470	320
Total area inside seat, sq.in.	989	989
Area of vent holes, sq.in.	41	517
Per cent of vent area	4.1	53.0

These covers show no perceptible distortion under heavy traffic until after months of heavy wear, when some of the side braces loosen slightly at the rivets and the cover must be repaired. To minimize this the main bars should be placed parallel with the flow of traffic. Probably an all-welded cover would give better wear.

L-M DISTRIBUTION TRANSFORMER

It's an



17 EFFICIENCY FEATURES! 25 YEARS OF EXPERIENCE!

Built into every L-M Distribution Transformer are 17 Efficiency Features... developed and tested in the laboratory... proven on the line in actual service.

Back of the improved L-M design are 25 years of experience in building high quality electrical equipment.

You can buy L-M Transformers with confidence... L-M Design plus the L-M Quality Reputation assure you extra years of service and low maintenance cost.

CATALOG T-2 GIVES FULL DETAILS — WRITE FOR IT!

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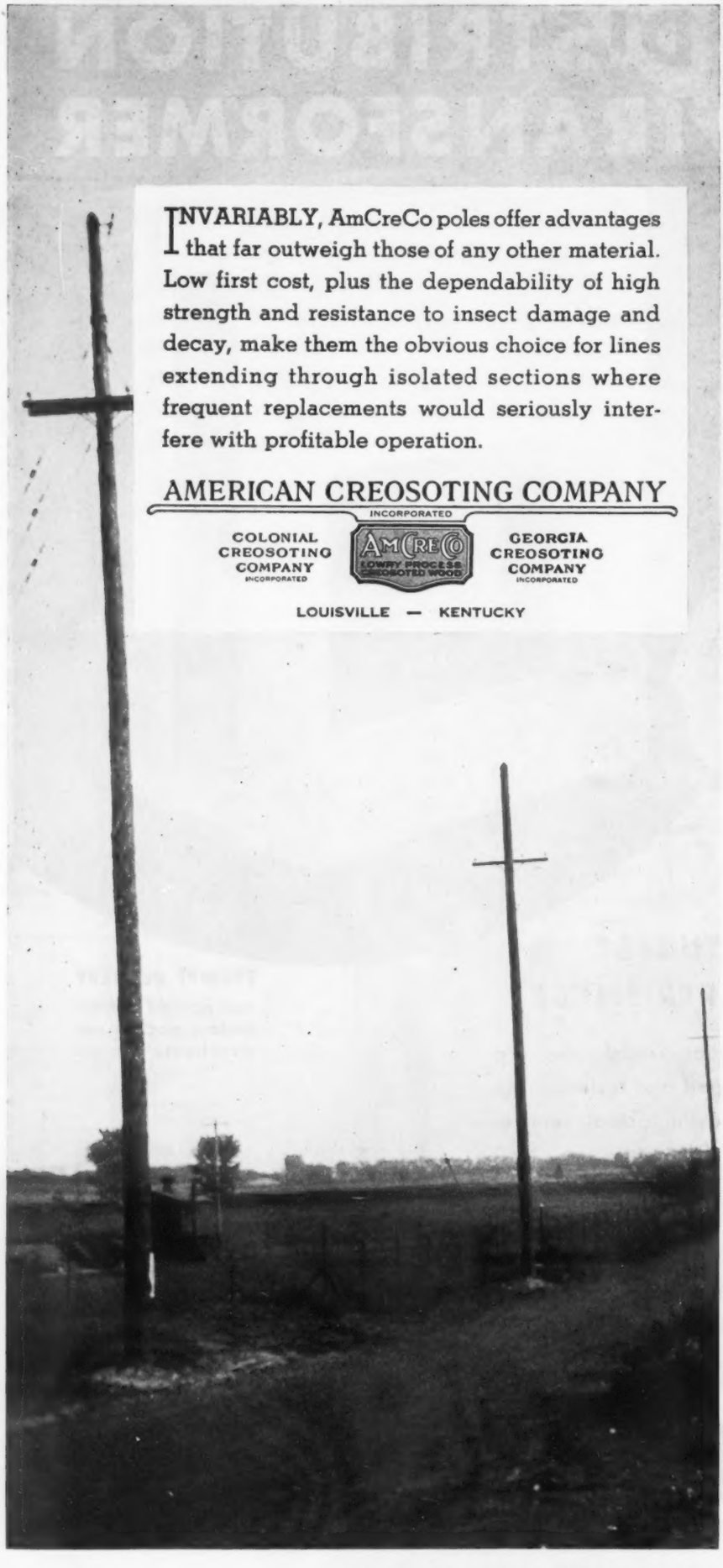
LINE MATERIAL CO.
SOUTH MILWAUKEE, WISCONSIN, U. S. A.


INVARIABLY, AmCreCo poles offer advantages that far outweigh those of any other material. Low first cost, plus the dependability of high strength and resistance to insect damage and decay, make them the obvious choice for lines extending through isolated sections where frequent replacements would seriously interfere with profitable operation.
AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY INCORPORATED
AMCRECO LOWRY PROCESS CREOSOTED WOOD
GEORGIA CREOSOTING COMPANY INCORPORATED
LOUISVILLE — KENTUCKY

Pre-Make Switchboard Wiring on Panel Template

[*Continued from page 43*]

accumulated. The entire wiring may be completed before the panel has made its appearance on the assembly floor. Since the drilling and wiring templates are made simultaneously, wiring supports and connections will fit readily into place.

This method of assembly has an advantage in the event of burn-out after installation. Since it does not require the presence of the actual devices, it is possible to use the arrangement drawings of the original equipment and duplicate the back-of-board assembly at the factory in the above manner. Consequently the front of the board arrangement serves as a supplementary record of the panel wiring. After the wiring has been formed and shipped to the installation it can be readily assembled on the associated panels.

T.V.A. Rural Lines

[*Continued from page 44*]

line fuses are so co-ordinated with trunk line oil circuit breaker relays that the probability of blown line fuses is remote except on line faults.

This construction has demonstrated its ruggedness and reliability and there are several factors which make it economical in first cost, operation and maintenance as follows:

1. Simple construction with small number of parts.
2. Expansion without change in original installation.
3. Small number of items to carry in stock.
4. Small stock inventory.
5. Localization of service interruptions.
6. Quick and easy location of faults.

There were 524 miles of this type of construction in service or under construction in Mississippi, Tennessee and Alabama as of January 1, 1936. Much of this has had more than a year of use and is giving good service.

•

Landers, Frary & Clark to Build $150,000 Plant

Landers, Frary & Clark, New Britain, Conn., have awarded general contract to A. F. Peaslee, Inc., 15 Lewis Street, Hartford, Conn., for a six-story addition to plant, 60 x 300 ft., to be used for electric refrigerator manufacture. Work on steel frame superstructure will begin at once. New unit will cost close to $150,000. W. F. Brooks, Hartford, is architect.

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers

Customer Office Open 24 Hours a Day

"I have to get to the light company office before closing time to pay my bill, because this is the last day I can pay it and get the discount." No woman ever makes this statement in Columbus, Ohio, to explain why she is rushing through her shopping and "can't take time to look at that perfectly darling hat, my dear." Because, you see, the downtown customer office of the Columbus Railway, Power & Light Company has no closing time. It is open 24 hours a day, every day.

Back in 1925 the company started its 24-hour office for the convenience of its transportation patrons, a place for receiving and restoring articles lost on street cars and buses, for the sale of tickets and for general information. Then people began to say, "Why can't I pay my electric light bill while I am here?" and the company soon perceived that the only good answer to the question was, "Why, you can." And then came requests for additional services easy to provide, such as receiving applications for service and disconnect and reconnect orders.

The after-hours office, as the company refers to it in advertising, has three regular eight-hour shifts. It averages approximately 200 calls a night; it has handled as high as 1,500 customers in one night. The average month sees upward of 6,000 bills paid there. On Saturday afternoons the heaviest load is noted. Last-payment-date days are heaviest, which indicates that the service is being taken advantage of by many who might otherwise be delinquent. More than 100 new contracts and countless general information requests come in at the counter each night. The office has a one-man force at all times—with the exception of Saturday afternoons. Representatives of the service, contract and commercial offices augment the special two-man cashier load during those hours.

In one evening receipts have totaled as high as $3,000. There is little danger of losses through holdups or robberies. A burglar-proof safe system is installed in this office as in every other cashier office on the company's property. The system provides a safe that cannot be opened by the attendant. He can deposit money in it, however, which he does when his receipts run over $50. He has only $50 in his change drawer at any one time.

"There is no measuring stick from a dollars-and-cents point of view," said Cashier T. A. Banks, "but the after-hours office has made us many friends It is logical to suppose that many who might otherwise be delinquent or slow pay have now found it easy to pay their bills—and pay them on time—through this office. We are safe in saying that during the bad depression years our credit problems would have been considerably more acute had this office not been in existence." Collections, he pointed out, are increasingly easier to handle. Service men no longer accept cash when they are sent out with disconnect orders. It is simple for them to instruct customers to come into the office to pay their bills "any time at all" and their lights will be turned on.

Purchased Power Sticker Reminder

As a part of its campaign directly to advertise purchased electricity in the oil industry member companies of the Petroleum Electric Power Club use these stickers on letters to persons in that industry. Other, and larger, advertising expenditures of the club are for space in oil trade and technical publications and for exhibits at shows of oil production, transportation and refining equipment.

Niagara Hudson Extends Rural Lines

The nation's largest utility company, Niagara Hudson System, announces that in 1936, 6,706 more rural and farm householders in its territory used electric service than in 1934. At the end of last year the system's companies were serving 28,634 farm and 123,392 "non-farm customers" in rural communities from 10,073 miles of rural distribution lines.

The resulting average figure of approximately fifteen customers per mile is exceptional and may be explained by the fact that 4,850 of the customers added in 1935 were served from then existing lines. The remainder of the new customers, totaling 1,856, were served from 452 miles of new rural distribution lines built during 1935. The system therefore secured approximately four customers per mile of rural line on its new construction.

President Alfred H. Schoellkopf of Niagara Hudson Power Corporation states that during 1936 the construction of about 2,000 miles of additional rural distribution lines is contemplated, with the addition of more than

7,000 farm and other rural customers. The ratio of these two figures is 3½ customers per mile.

A revised line extension plan for the system has been in effect since October 1, 1935. Minimum monthly charges were reduced in some cases by as much as $7.50. No customer will pay a minimum monthly charge of more than $4.50, and after a five-year use of energy no more than $2.

Approximately 45 per cent of all farms within the franchise territory of the system, situated on land classified by a state agency as suitable for permanent agricultural use, receive electric service from its lines. During 1936 Niagara Hudson companies are carrying on intensive promotional activities and lending their co-operation to various committees of farm leaders who have been interesting themselves in the development of rural electrification.

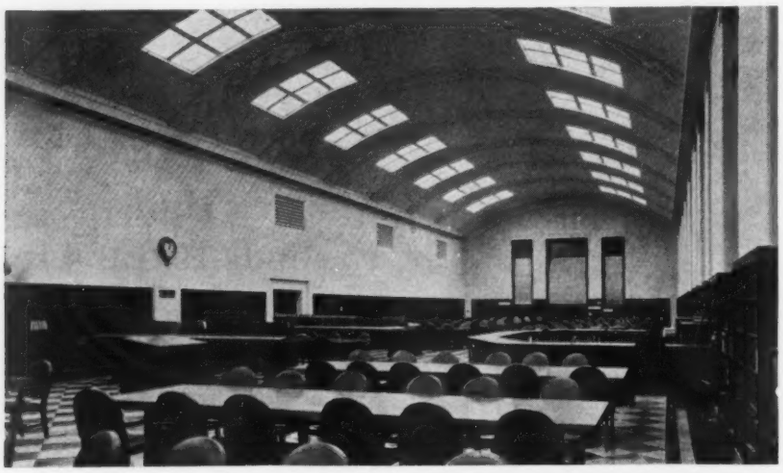
New Treatment for Library Lighting

In the new George Thomas Library of the University of Utah, Salt Lake City, lighting has been engineered rather than added into the building by Ashton & Evans, Salt Lake architects. Even intensities and shadowless illumination are the result.

An unusual skylight effect was achieved in the main reading room. This room, the center of activity, is 192 ft. long and 45 ft. wide with an arched ceiling 28 ft. high. Because acoustical plaster, having a light absorption factor of 50 per cent, was used on the walls and ceiling indirect lighting did not seem practical, nor would suspended fixtures improve the appearance of the room, which is designed with a pleasing simplicity.

The problem of adequate illumination was solved by installing two rows of six-section, 6x9-ft. diffused glass panels flush with the ceiling to simulate skylights. Behind each of the sections in each panel an 18-in. RLM unit is mounted in a sheet metal box designed to redirect the spill light. Lamped with 200-watt globes, the 144 units represent 3½ watts per sq.ft. of floor surface, which provides an even intensity of 10 ft.-candles over the entire room area. Maintenance on the installation is carried on from above.

In the hallways diffusing glass panels have been built in as an integral part of the decorative treatment. These panels, extending the whole length of the hall, are rectangular in shape with the illuminated panels on the side and bottom.



Artificial skylight effect, obtained by mounting lighting units behind diffusing glass panels installed flush with the arched ceiling, provides an even intensity of illumination and a pleasing appearance

Hallway illumination is a good example of the pleasing decorative effects that can be obtained by using lighting as an architectural material rather than as a necessary adjunct to the room

Chicago Sets Record in Air Conditioning

Chicago continues as the "ace" air-conditioning city of America, with installations totaling 1,181 (54,839 hp.) at the end of the first six months of 1936. A new installation record for the city of 247 plants (6,897 hp.) installed or contracted for was established during the first six months of 1936, according to the Commonwealth Edison Company. This is 34 per cent more than the 184 installations reported for the same period last year.

Perhaps significant is the fact that one of the greatest increases was in the office classification. Seventy-nine air-conditioning systems were installed in Chicago private and general offices in this six-month period. Three Chicago hotels—the Stevens, Palmer House and Harding—installed air conditioning in guest rooms, which is an innovation for Chicago. It is expected that several other local hotels will make similar installations in the near future.

Classification of Air-Conditioning Installations in Chicago

Jan. 1, 1936-July 1, 1936

Banks	2	Residences	14
Investment houses	6	Restaurants	52
Beauty shops	2	Candy stores	9
Clubs	2	Clothing and department stores	14
Doctors' and dental offices	6	Hotels	4
Drug stores	9	Fur stores	9
Food stores	1	Shoe stores	8
Candy factories	1	Miscellaneous stores	8
Printing plants	3	Undertakers	6
Miscellaneous industrial uses	7	Theaters	11
General offices	30		
Private offices	49	Total	247

"What's new at the Home of Welding, Lad?"

"Something New Every Minute, Pop! Get Hep to These Lincoln Cost-Cutters!"

"New electrodes include service-proved "Chromeweld 4-6" and "Aerisweld." Look at the list! There's a Lincoln electrode for every essential welding need.

"New electrode holders have cable clamps that can be tightened or loosened by simply inserting an electrode through the hole in the cap screw and using the electrode as a lever . . . Welding cable has been made tougher and more flexible . . . head shields are lighter—just as comfortable as an old felt hat . . . spatter-proof lens has been developed . . . protective apparel far outlasts the predecessors.

"The new things you get from the Home of Welding are as interesting as a letter from home. Send the coupon home to THE LINCOLN ELECTRIC CO. Dept. U -288, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World."

for mild steel
"FLEETWELD 5"
"FLEETWELD 6"
"FLEETWELD 7"
for high tensile steel
"SHIELD-ARC 85"
for light gauge steel
"LIGHTWELD"
for 18-8 stainless steels
"STAINWELD A"
for 25-12 stainless steels
"STAINWELD B"
for 4-6 chrome
"CHROMEWELD 4-6"
for high manganese steel
"MANGANWELD"
for moderate shock and abrasion
"HARDWELD"
for rolling or sliding abrasion
"WEARWELD"
for impact and severe abrasion
"ABRASOWELD"
for cutting edges
"TOOLWELD"
for cast iron
"FERROWELD"
for welding aluminum
"ALUMINWELD"
for general welding purposes
"STABLE ARC"
for bronze, brass and copper
"AERISWELD"

A tougher, stronger, more flexible *"Stable-Arc"* cable.

Holders have been improved from jaw to grip.

Head shields are lighter, more comfortable.

Write for this Up-To-Date Welding Procedure Guide! It's FREE.

THE LINCOLN ELECTRIC CO.
Dept. U-288, Cleveland, Ohio

Please send a free copy of the 36-page Welding Procedure Guide.

Firm Name _____

Your Name _____ Title _____

Address _____

City _____

State _____

News ABOUT PEOPLE

Curtis Lighting Names New Chicago Sales Manager

Charles E. Johnson, formerly advertising-sales promotion manager of Curtis Lighting, Inc., has been appointed Chicago sales manager to be in charge of all Curtis sales activities

in the Chicago territory which is comprised of Chicago proper and the suburban territory. Mr. Johnson is well known in the commercial lighting field and has to his credit a wide and varied experience in sales work, obtained both in the United States and Canada.

•

▶ GEORGE OTIS SMITH of Skowhegan, Me., former director of the United States Geological Survey, has been elected a director of the Central Maine Power Company, as has MORRIS B. PERRY, a Rockland, Me., bank director.

▶ GROVER C. DILLMAN was inaugurated as president of the Michigan College of Mining and Technology on August 6. At the same time the degree of doctor of engineering was conferred on him.

▶ DON J. LUTY, chief engineer and sales promotion manager of the air conditioning division of Gar Wood Industries, Inc., is traveling through the East and is personally conveying the latest information and rendering engineering explanations about the numerous new developments of Gar Wood products to branch managers and dealers who operate in eastern territories.

▶ JOHN J. O'DONNELL, for the past three years a factory representative of the U. S. Electrical Manufacturing Company, Los Angeles, Cal., in northern New Jersey, Pennsylvania, Maryland and Delaware, has been appointed sales representative for the New England states, succeeding C. F. Poirier. His headquarters are at 25 Huntington Ave., Boston, Mass.

▶ PHILIP B. PROCTOR, for the past five years distribution engineer of the Malden (Mass.) Electric Company, has joined the production control department of the Johns-Manville Company with present headquarters at Manville, N. J. Mr. Proctor joined the Malden company eight years ago after graduating from the mechanical engineering course of M.I.T.

E. E. Potter, Eastern sales manager of General Electric's incandescent lamp department (left), wishes N. H. Boynton, Western sales manager, "Bon Voyage." Mr. Boynton sailed on the S.S. *Hamburg* on July 29. He will visit England, France and Germany.

R. W. Turnbull Assumes New Executive Duties

R. W. Turnbull, who was elected vice-president, general sales manager and a member of the board of the Edison General Electric Appliance Company

(Electrical World, August 8, page 14), has been identified with the electrical appliance business for twenty-six years. He began his career with the Southern California Edison Company in 1910. The following year he joined the Pacific Electric Heating Company, Ontario, Calif., original manufacturers of Hotpoint products. In 1912 he entered the employ of the General Electric Company as Pacific Coast heating device specialist, continuing in that position until 1917.

In 1918 the G.E. heating device section was merged with the Hotpoint Electric Heating Company and the Hughes Electric Heating Company to form the Edison Electric Appliance Company and Mr. Turnbull the following year was placed in charge of Pacific Northwest sales. Subsequently he became manager of the entire Pacific Coast district, and later vice-president in charge of sales with offices in Chicago. When the traffic appliance business was moved to the G.E. merchandise department at Bridgeport, Conn., in 1932 he became assistant appliance sales manager and in 1935 manager of traffic appliance sales.

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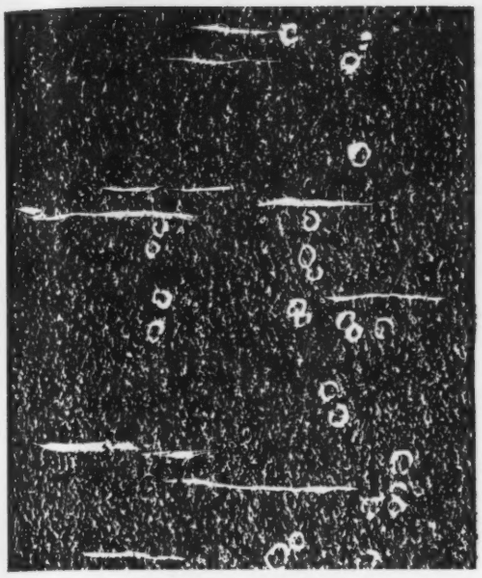
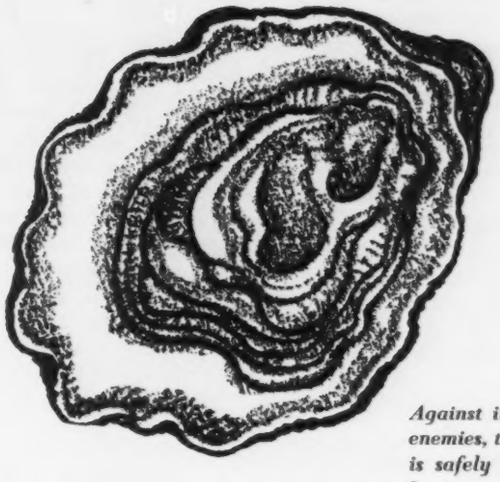
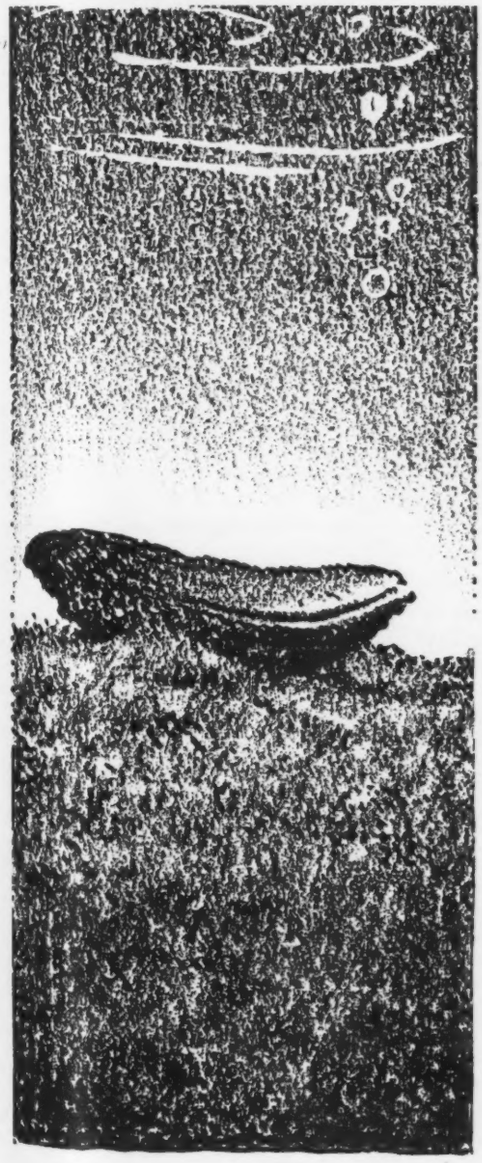
▶ GEORGE L. ELLERBECK has been appointed superintendent of power sales in the general sales department of the Utah





Against its marine enemies, the Oyster is safely Protected by its strong shell.

PROTECTION



YOUR heating load is likewise *protected* by the durability of Chromel heating-elements. And Chromel itself builds up its own protection against the ceaseless attack of atmospheric oxygen. On the metal is formed a skin of oxide which air can scarcely penetrate, and which effectively retards further oxidation. This partly explains the fine durability of Chromel heating-elements—a durability so outstandingly fine, that in the 30 years since Chromel was discovered, no substitute alloy has ever been found. So, you protect your own interests, when you specify that your heating load is to be generated through elements made of Chromel.... You'll find useful data on heating-unit design in Catalog-KW.... Hoskins Manufacturing Co., Detroit, Mich.

H O S K I N S

CHROMEL

THE *wire* THAT MADE ELECTRIC HEAT POSSIBLE

Power & Light Company. Mr. Ellerbeck succeeds Glen B. Walker, who assumes new duties involving special work in connection with large power users. Mr. Ellerbeck entered the employ of the Utah Power company in 1927 as commercial lighting salesman. In 1929 he was placed in charge of the commercial lighting department in Salt Lake City and accomplished excellent results in the promotion of commercial lighting activities. During the early part of 1936 he was promoted to the position of assistant to the supervisor of commercial sales, which position he held at the time of taking over his new activities as superintendent of power sales.

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OBITUARY

Alfred Alsaker

Alfred Alsaker, chief engineer of the Delta-Star Electric Company, died at Long Beach, Long Island, August 3, following injuries received when struck by a motorcycle. Born near Bergen, Norway, in 1884, he was educated there, receiving his electrical engineering degree in 1904, and for a short period was installation engineer for Allgemeine Elektricitäts Gesellschaft.

Employed by the Commonwealth Edison Company, Chicago, in 1906 and 1907, he transferred to the Public Service Company of Northern Illinois in 1908, advancing to chief draftsman and then to engineer of station design, resigning in 1916 to affiliate himself with the Delta-Star Electric Company.

Mr. Alsaker was a member of the American Institute of Electrical Engineers, Western Society of Engineers and the Norwegian-American Engineering Society. He recently completed a book entitled "The Capitalistic System and the Nature of Unemployment," treated in an engineering and mathematical manner. The book is scheduled for publication in the near future, but it was not for him to see in final form the result of his labors during most of the depression years.

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▶ IRVIN F. LEHMAN, president of the Blaw-Knox Company, Pittsburgh, Pa., died suddenly August 5 near Hartford, Conn., in his sixty-sixth year. He had been in ill health for several months. Mr. Lehman, who was co-founder of the company he headed, was born in Pittsburgh. The Blaw-Knox Company was founded in 1917 when the Knox Pressed and Welded Steel Company and the Blaw Steel Construction Company, owned by Mr. Lehman and a brother, Albert C. Lehman, were consolidated. Albert C. died two years ago. Mr. Lehman was an officer and director of other industrial enterprises.

John J. O'Brien

John J. O'Brien, president of H. M. Byllesby & Company and the Standard Gas & Electric Company, and one of the foremost utility executives of the country, died August 7 at his home in Chicago, in his sixty-seventh year. Endowed with analytical ability, a strong sense of justice and independence of thought and action, Mr. O'Brien was among those who led the public utility industry to its great achievements.

He was born in Chicago and received his education in the local parochial and public schools and a business college. He went to work for the Pullman Company when he was only 18 and two years later became connected with the United Edison Company. When this company was merged with the General Electric

Company in 1892 he became accountant in charge and remained with the company until 1902. In the founding of the Byllesby System in that year he was selected by the late Col. H. M. Byllesby as a partner in the undertaking. To the new organization he brought accounting and financial ability and a broad knowledge of the electrical industry.

At first he served as treasurer and general auditor, later as vice-president, and in 1924 he was elected president to succeed Colonel Byllesby. The utility operating companies, which have functioned since that time under his management, serve more than 1,600 towns in twenty states. He was a director and officer in virtually all the large Byllesby holding companies.

•

▶ LEWIS A. LAWRENCE, for 39 years production engineer of the Green Mountain Power Corporation and its predecessor, the Montpelier & Barre Light & Power Company, died at his home in Montpelier, Vt., on July 12, at the age of 65.

▶ CHARLES I. BRINK, a pioneer in the electrical advertising field and for many years a prominent manufacturer of electric signs at Boston, Mass., died in Newton, Mass., on July 17, after an illness of ten weeks. He was born in Sweden 68 years ago. Coming to America as a young man, he later became associated with Claude Neon Signs, Inc., and developed this business over a wide area in the northeast.

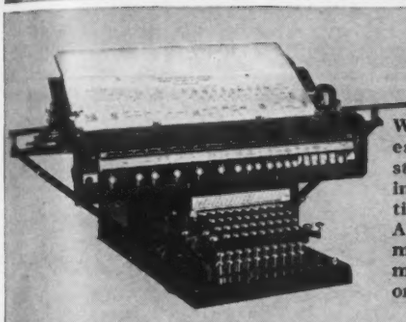
▶ B. C. LEWIS, sales manager of research products for the Northern Electric Company, died recently from injuries received in an automobile accident in Montreal, Canada. He had been with the company for some years.

▶ OTTO WASHBURN, manager for the Wisconsin Power & Light Company at DeForest, Wis., died July 22. He had been associated with the utility company for seventeen years.

▶ ROY HUSSELMAN, consulting engineer in charge of designing the Memphis municipal system for T.V.A. power, died, of a heart attack, on August 6 at his home in that city. He was 53 years of age. Mr. Husselman became identified with the T.V.A. undertaking in 1934 when he was awarded a contract to survey the cost of a power distribution system for Memphis. His findings brought rapid developments in the formulation of the Memphis program. Since last fall he has also been consulting engineer to the Chattanooga electric power board. For 30 years he had been prominent in the engineering field, specializing in designing, construction, operation and appraisals. He had conducted surveys for numerous municipalities and had frequently represented government agencies. From 1912 to 1915 he was in charge of design and construction of Cleveland's $3,000,000 plant. In 1931 he was engaged by Governor Pinchot to investigate the public utility companies of that state and more recently served as chief utility engineer for the New York legislative committee investigation public utilities.

▶ W. A. HILLEBRAND, widely known in the electrical industry, died in Akron, Ohio, July 24, following a brief illness. Mr. Hillebrand was graduated from Cornell University in 1905. His connections include the Western Electric Company, the teaching staff of Leland Stanford and Oregon State College, the Pacific Gas & Electric Company and the Federal Telegraph Company. He joined the Ohio Brass Company in 1919 as a commercial engineer located on the West Coast. After spending some eight months in Japan in 1925 he returned to the Ohio Brass Company at Barberton as consulting electrical engineer. In 1932 he left to assume the professorship of electrical engineering at the University of California. Since that time his vacations during the summer have been spent with the Ohio Brass Company in Barberton in the capacity of consulting engineer.

Burroughs



BURROUGHS TYPEWRITER ACCOUNTING MACHINE

Writes check (or pay envelope), earnings record, employee's statement and payroll summary in one operation. Column selection automatically controlled. All totals accumulated. This machine is only one of several models; payroll work is only one of the many jobs they do.

SIMPLIFIES PAYROLL ACCOUNTING *and gives you the additional information required by the* **SOCIAL SECURITY ACT**

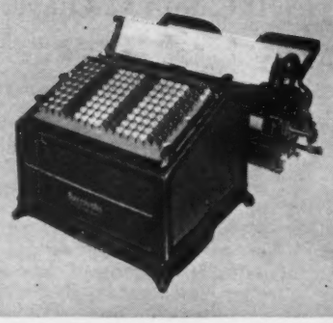
BURROUGHS DESK BOOKKEEPING MACHINE

Posts earnings records, automatically prints dates in proper columns, automatically subtracts deductions—calculates net pay. Can also be used as a fast, practical adding-subtracting machine for all kinds of accounting work. Many styles and many models—all low in price.

BURROUGHS CHECK-WRITING TYPEWRITER

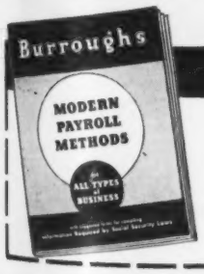
Writes payroll checks in units or in strips. Payroll summary completed in same operation. Fast and easy insertion and removal of checks. Can also be used as a typewriter for correspondence and general typing. Electric carriage operation. Several models.

BURROUGHS offers many new and improved machines which not only supply the additional payroll information required by the Social Security Act, but also handle the entire payroll job with exceptional speed, ease and economy. It will pay you to investigate these new machines. Telephone the local Burroughs office, or send for the new payroll folder described in the coupon below.



BURROUGHS AUTOMATIC PAYROLL MACHINE

Writes check (or pay envelope), employee's earnings statement, earnings record and payroll summary in one operation. Accumulates all necessary totals, automatically ejects and stacks checks in order. Many models for payroll work, as well as for scores of other accounting jobs.



SEND FOR THIS NEW PAYROLL FOLDER!

BURROUGHS ADDING MACHINE COMPANY, 6938 SECOND BLVD., DETROIT, MICH.

Send me the new folder "Modern Payroll Methods," illustrating complete payroll accounting methods, with typical forms for maintaining the information required by the Social Security Act. The forms show representative entries and suitable column headings.

Name_____ Address_____

New EQUIPMENT AVAILABLE

Live-Line Indicator

Glow of a rare-gas tube in a simple potential detector recently announced indicates that an a.c. circuit is energized. So that it may be used outdoors, the rare-gas tube—mounted in bakelite tubing—is shielded by a

"Glowtector" for a.c. circuits, 2,200 volts and above, 25 cycles and above. **Railway & Industrial Engineering Co.**, Greensburg, Pa.

bakelite hood, to which is attached an extension handle. At the upper end of the hood is an S-shaped electrode. To detect voltages of 2,200 to 10,000 volts this electrode is placed in contact with the bare conductor. On higher voltages it needs to be touched only to the insulation.

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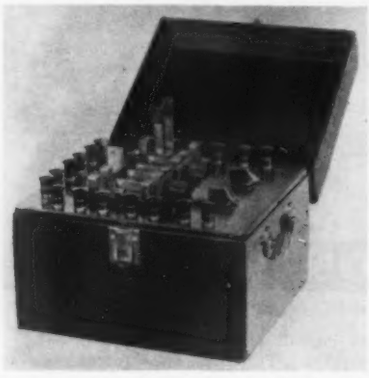
Relay Testing Box

One man can operate a recently announced portable testing box in making field tests related to the setting of distance, reactance or impedance relays and their performance under fault conditions. External resistors



Portable relay testing box; weight, 15 lb.; outside dimensions when closed, 9x10x7½ in.; developed for type GCX high-speed distance relays, it can be adapted to other types. **General Electric Co.**, Schenectady, N. Y.

and reactors are used with it, but no phase angle meter is required, it is claimed. Multiplication of the fault reactance by a dial setting, from which errors due to reading or calibration are eliminated, is the necessary calculation.

•

Public Utility Truck

An entire crew can be sheltered in the seven-man cab of this 3-ton, four-wheel-drive public utility truck. Standard equipment includes platform-type body, double drum, irreversible-type winch, boring machine and collapsible, T-type pole derrick. Four doors permit the crew to get in and out of the cab without disturbing the driver. Five transmission speeds are available for winch operation through the built-in power take-off. The boring machine, also operated by the power

Three-ton, four-wheel-drive truck; cab sealed against carbon monoxide; five speeds forward, two reverse. **Four Wheel Drive Auto Co.**, Clintonville, Wis.

take-off, is capable of boring holes from 9 to 36 in. in diameter, and the pole derrick will set a 55-ft. pole, manufacturers state.

•

D.C. to A.C. Converters

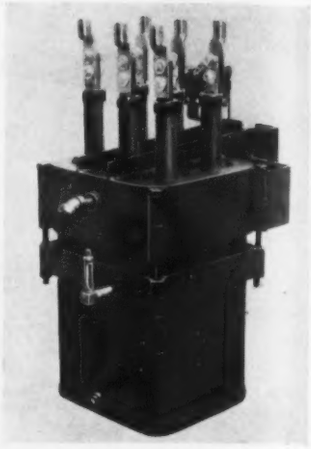
Convert 6, 12 or 32 volts d.c. to 60 cycles, 110 volts a.c. Rated at 40 watts output. Dimensions: 4x5x2¼ in. Weight 6¼ lb. **Carter Motor Co.**, Chicago, Ill.

Designed for locations where a.c. is not available, new, small-size, d.c. to a.c. converters are said to solve the problem of operating small a.c. devices requiring an output of 40 watts or less. Cases cooled by air vents, dynamically balanced armatures, rubber mountings and bearings that require no oiling are features of these units, which operate continuously at constant output, according to the manufacturers.

•

Indoor Ciruit Breakers

A line of oil circuit breakers with 50,000 and 100,000 kva. interrupting ratings, whose dimensions fit them for use in inclosures of many types, is being marketed. Manufacturers claim that these rectangular, single-tank circuit breakers effect quick quenching of the arc. This decreases oil and breaker



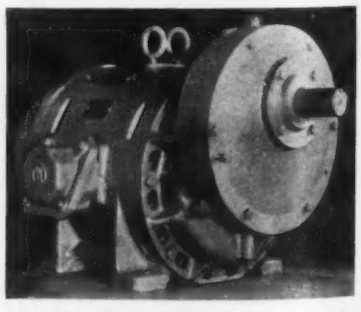
Class 50, Type TCR-1, 600 amp. "Turblator" oil circuit breaker; available in 600 to 2,000 amp., 7,500 and 15,000 volts, 50,000 and 100,000 kva. interrupting ratings. **Roller-Smith Co.**, New York City.

deterioration and reduces the circuit interrupting time. Alloy steel heads and bearing pins, bakelite insulators with special grounding shields to prevent corona discharge are features. Mechanisms are completely internal, balanced and self-lubricating.

•

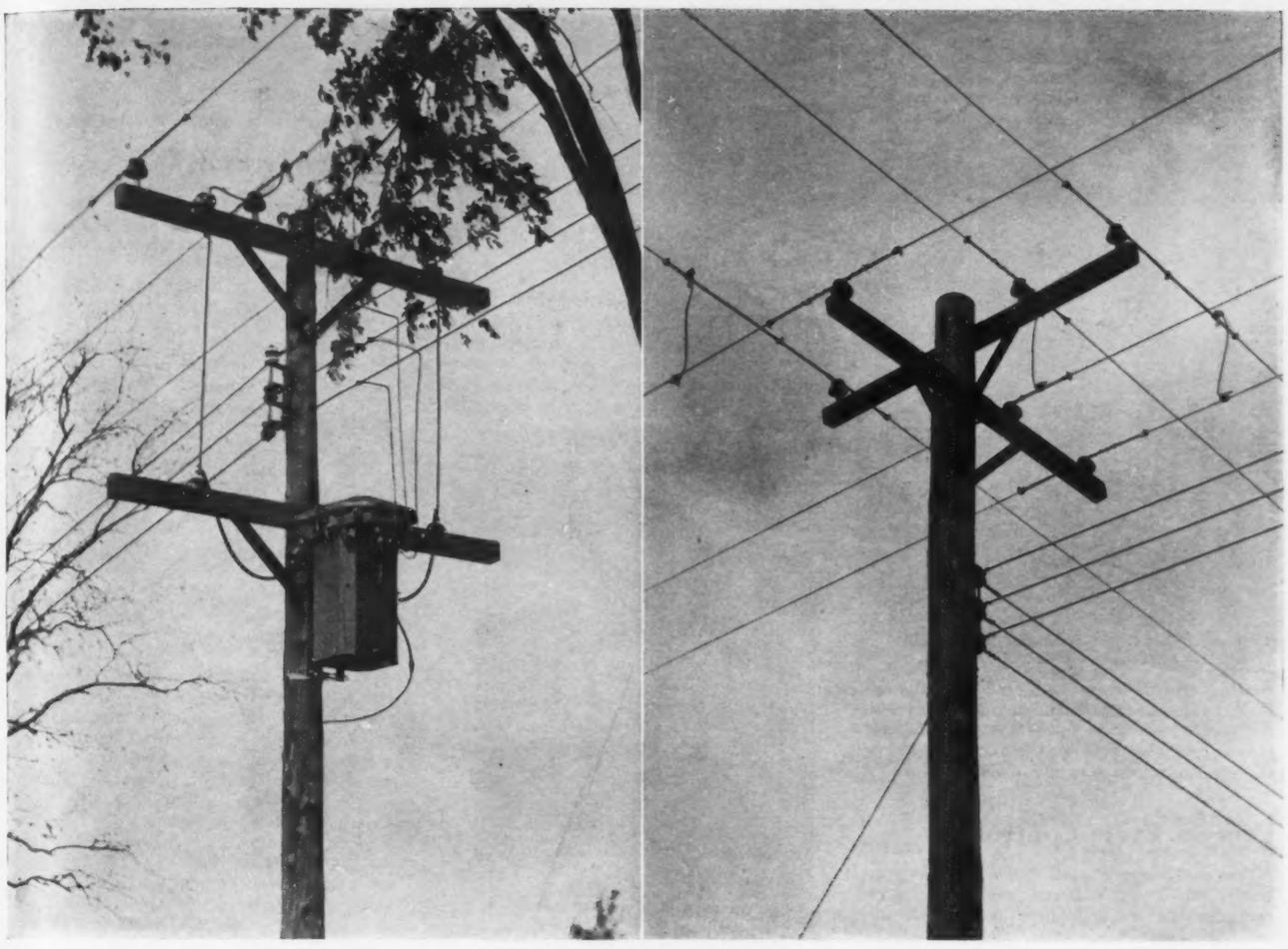
Single Reduction Gearmotors

Single reduction, explosion-proof motors for use in hazardous locations where speed reduction is required are now available. Heat-treated gears of the single helical type and anti-friction bearings are used in these motors. Inspected and approved for use in



Single reduction gearmotor for Class 1, Group D hazardous locations; in sizes from 1½ to 75 hp. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pa.

atmospheres containing gasoline vapors, ethyl and methyl alcohols, petroleum products, acetone, solvent vapors, these motors may also be used in dry-cleaning, dry-dyeing plants, paint manufacturing and gas plants, according to the manufacturers.



EIGHT STRAND A·C·S·R

LOWER COST • • GREATER RELIABILITY

The crux of the rural problem is the cost of erecting good lines. 8-strand A. C. S. R. bites into this cost.

Twenty-five per cent greater strength permits longer spans, with fewer poles and fewer fittings. Stresses are kept within limits which experience has shown to be reasonable and safe. Fittings are interchangeable with 7-strand. Obviously costs go down. But neither service reliability nor permanence are neglected.

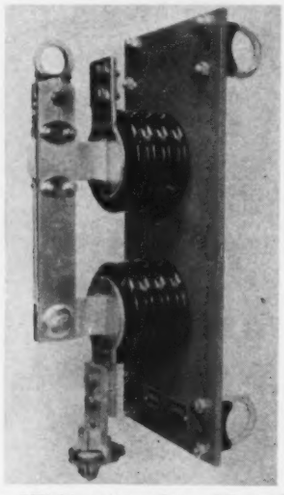
There are also the standard A. C. S. R. advantages. Arcs striking Aluminum are unstable and therefore cause only superficial burns which are rarely serious. At all times the stressed steel core is completely sheathed in Aluminum strands.

For further protection against arcs and reinforcement against vibration-fatigue and abrasion, Armor Rods have been developed by our engineers. They are a part of A. C. S. R. service available to you, and we are also glad to give cooperation on all technical problems of erecting rural lines. Write for information. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

Disconnecting Switches

Featuring a locked blade and arranged for mounting on flat surfaces or on pipes, a line of indoor disconnecting switches has been introduced. A lock, attached to the



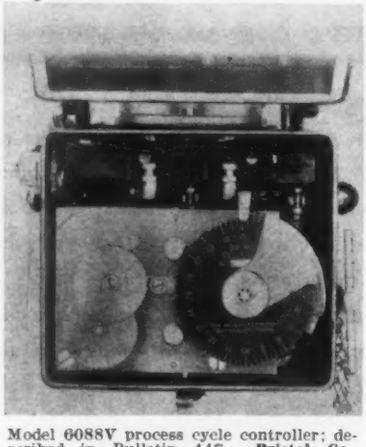
Type CJH-14 ratings from 7.5 to 34.5 kv. **Delta-Star Electric Co.**, Chicago, Ill.

floating type, two-section blade, automatically engages when the blade is closed, releases when it is opened. Solid copper tongue-type contacts and clamping, solderless-type terminal lugs are used.

•

Process Cycle Controller

A simply constructed process cycle controller has recently been developed that is designed particularly for the rubber and molded plastics industries. It is also suitable for automatically controlling other cycle processes which operate on a cycle that must be changed from time to time. One cam, ad-



Model 6088V process cycle controller; described in Bulletin 447. **Bristol Co.**, Waterbury, Conn.

justable to carry out various time cycles, operates one or two patented three-way pilot valves, as the process requires. Speed variation is obtained with a single cam, through the use of a novel two-speed cam operating mechanism.

•

Air Compressors

Three- and six-cylinder, vertical-angle two-stage, air-cooled compressors; capacities from 142 to 445 cu.ft. per minute. **Worthington Pump & Machinery Corp.**, Harrison, N. J.

A new line of compact three- and six-cylinder, vertical-angle, two-stage air compressors is now available. Three-cylinder units have two low-pressure cylinders set opposite each other at an angle, with high-pressure cylinders vertically between. Six-cylinder units are similar, with two cylinders side by side in each position. Features include automotive-type pistons, articulated connecting rods, finned, radiator-type intercooler, oil cooler and oil filter. A variety of drives is available, making the compressors easily adaptable to many installations.

•

Insect Control Device

An electrical trap, designed to provide insect control in orchards, on fruit farms and similar locations, has been marketed recently. It consists essentially of a gaseous mercury vapor light source inclosed in a grille of charged wires. Insects, attracted

"Electracide Giant" rated at 1,200 watts; non-corrosive materials used throughout. **Folmer Electracide Corp.**, Rochester, N. Y.

by the mercury vapor light, to which they are extremely sensitive, fly against the grille and are electrocuted. It is claimed the lamp will control insects over an area of 6 to 10 acres. The trap operates at night, during off-peak load periods.

•

Electrical Castings

Heat-treated castings from new copper-base alloy; properties of standard test bars: electrical conductivity, 50 per cent; tensile strength, 95,000 lb. per sq.in. **Beryllium Corp. of Pennsylvania**, Reading, Pa.

Heat-treated electrical castings for which high strength and hardness, high electrical and thermal conductivity is claimed may now be secured. Essentially a copper-base alloy, small amounts of beryllium and cobalt have been added to give hardness.

•

Current Transformers

"Universal" current transformers; for 2,500 volt circuits, 25-125 cycles, 25 volt-amperes; compensated to be correct at 15 volt-amperes; nine primary ranges, from 10-800 amp. **Esterline-Angus Co.**, Indianapolis, Ind.

New nine-range, metal-clad, portable transformers, which make possible accurate measurements in most circuits with a single pair of transformers, have been announced recently. Five of the nine primary ranges are obtained by means of the wound primary; the four others are obtained by looping the primary through an opening in the core and the case. Rugged, aluminum cases of these transformers are moisture-proofed. Transformers are subjected to a test voltage of about 14,000 between the primary and secondary windings and between the windings and the case. This is usually sufficient to arc from the terminals to the case. It is claimed that both windings will carry double normal current continuously without dangerously overheating.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

CIRCUIT-BREAKERS IN STEEL MILL — Description of circuit-breaker installations in a steel mill is in Bulletin 935 of I-T-E Circuit Breaker Company, Philadelphia, Pa. The 12-page booklet accompanies the brief description with pictures and diagrams of installations for the control and distribution of 440-volt a.c., 250-volt and 600-volt d.c. Mechanical features of the breakers are also shown.

WOUND-ROTOR MOTORS — Specifications and mechanical features of wound-rotor motors for two and three phase a.c. are outlined and pictured in Bulletin 117 of Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, Ohio. A small table of applications is also in the 4-page folder.

MAGNETIC COMPARATOR—Research Paper RP 894, issued by the National Bureau of Standards, U. S. Department of Commerce, describes the use of an alternating-current magnetic comparator—essentially an alternating-current bridge—for testing tool-resisting prison bars. Copies may be secured from the Superintendent of Documents, Washington, D. C., for 5 cents.

GASOLINE ELECTRIC PLANTS—Design features and description of small—300 to 5,500 watts—gasoline electric plants, both a.c. and d.c., are in an illustrated folder issued by the Janette Manufacturing Company, 556 West Monroe Street, Chicago, Ill. The folder is Bulletin 23-1.

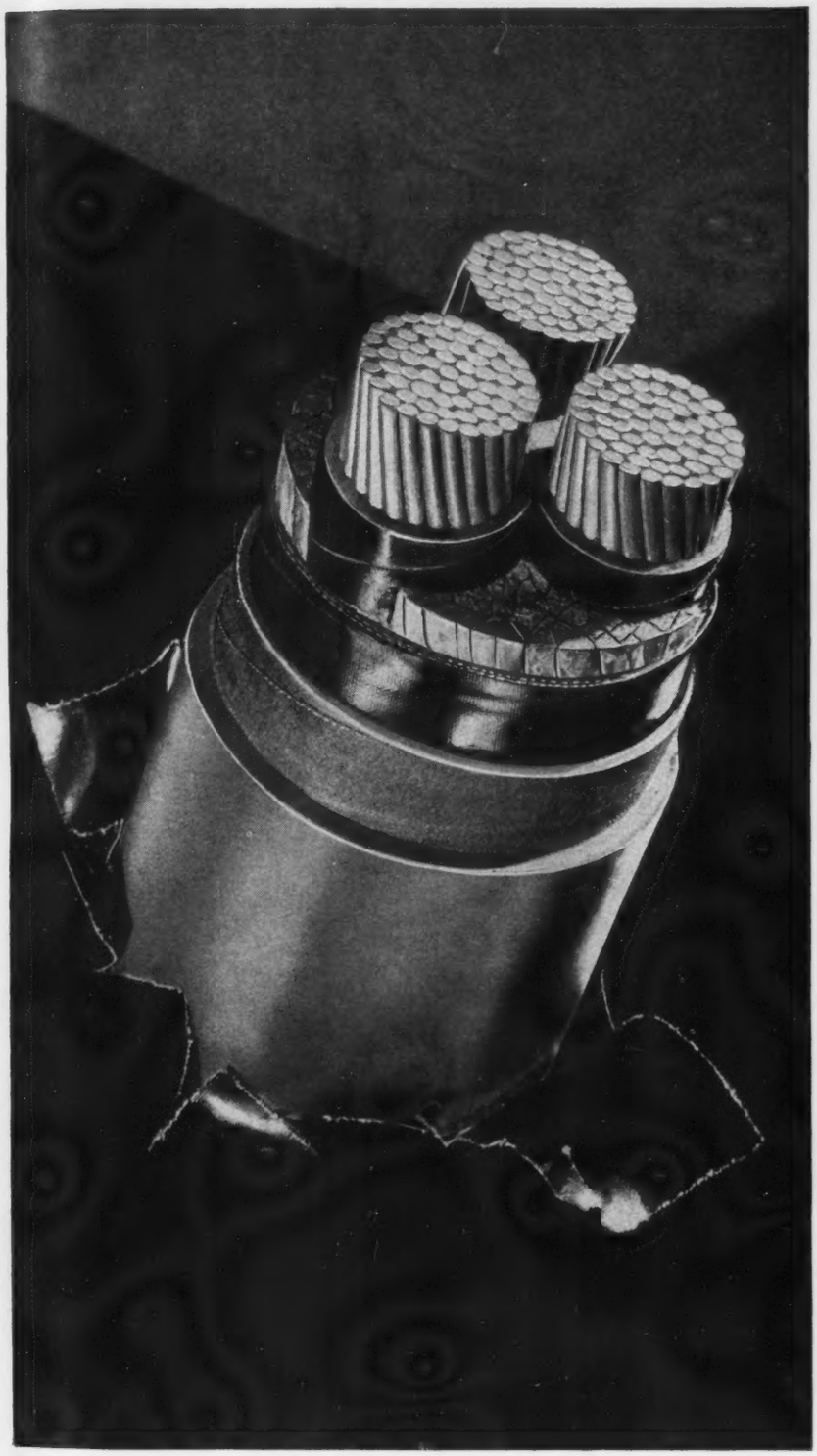
CONDUIT BOOKLET—A 32-page booklet, "Transite Conduit and Korduct for the Electrical Industry," has been recently issued by the Johns-Manville Corporation, 22 E. 40th Street, New York City. Well illustrated, the booklet includes data on the strength, resistance to corrosive soils and electrolysis, uses and applications, and tables of weights and sizes of this product.

FUSE LINKS; DISCONNECTING SWITCHES—Dimensions, ratings and prices of fuse links for power line distribution cutouts are given in a 4-page bulletin (AD-1305) issued by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, Ill. Bulletin 210, published by the same company, shows design features, ratings, sizes and prices of porcelain-housed disconnecting switches.

RECORDING VOLTMETER—A simplified, portable, strip-chart recording voltmeter is described in bulletin GEA-2294 of General Electric Company, Schenectady, N. Y.

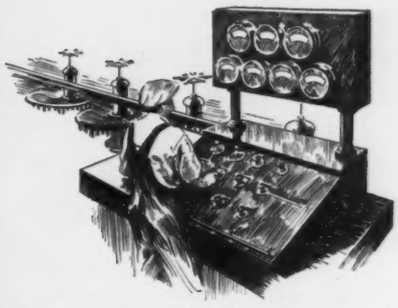
OIL CIRCUIT-BREAKER—Condit Electrical Manufacturing Corporation, Hyde Park Station, Boston, Mass., has issued Section 521, a 4-page folder describing an indoor, station type oil circuit-breaker of 100,000 kva. interrupting capacity, designed for 15-kv. service or less. Construction features, general dimensions and ratings of the circuit breaker are given.

COATINGS ON STEEL—A 10-page pamphlet, "Tentative Specifications for Electrodeposited Coatings of Zinc, Cadmium, Nickel and Chromium on Steel," has been issued recently. Copies may be secured from either the American Electro-Platers' Society, 90 Maynard Street, Springfield, Mass., or the American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pa., for 25 cents.



ROEBLING

Varnished Cambric Cables



Power Cable Test Panel with an ultimate capacity of 600,000 volts, one of many factory tests to which Roebling Wire and Cable is subjected.

A wealth of experience goes into the making of this fine cable. From copper to outer covering it is of traditional Roebling high quality ... the product of good materials, careful workmanship, and exacting tests.

Roebling Varnished Cambric Cable is available in single, two, and three-conductor types; for a wide range of voltages; in all commercial sizes.

Braided or leaded. Also with steel, zinc or bronze tape, or round wire steel armor.

We would welcome your inquiry for further information and prices in connection with this type of cable or any of the 60 other types at the left.

JOHN A. ROEBLING'S SONS CO.
Trenton, N. J. *Branches in Principal Cities*

OVER 60 OTHER TYPES

Power Cables: Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables: Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Slow Burning Wires and Cables » Weatherproof Wires and Cables » Submarine Cables » Portable Cords » And a wide variety of other wires and cables.

TRADE MARK JAR REG U.S. PAT. OFF.

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

DILECTO MOLDED TUBING

Retains its Form and Dimensions
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Molded Dilecto Tubing, made under heat and hydraulic pressure, is a homogeneous material, resistant to moisture to a high degree, with excellent electrical and mechanical properties. It is made to formula—uniform throughout—permanent in its characteristics.

Let us send you the Dilecto catalog of comparative facts and figures and other information you'll find of value for reference purposes.

CONTINENTAL-DIAMOND FIBRE COMPANY
NEWARK, DELAWARE

Municipal Plants

ARIZONA—Electrification of the San Carlos Irrigation and Drainage District around Florence, Coolidge and Casa Grande is contemplated in plans calling for a $300,000 bond election to be held within the next 90 days. The project includes the construction of 110 miles of transmission and distribution lines to serve more than 500 customers.

TULARE, CALIF.—Validity of the $288,700 evaluation of the distribution facilities of the Southern California Edison Company found by the California Railroad Commission in 1933 has been upheld in a decision handed down by the state supreme court. Suit testing the validity and fairness of the valuation had been brought by the company. The company contended in its suit that earnings should have controlling significance in the condemnation proceedings and that consequently it was entitled to receive more than $288,700 for its Tulare system, which being "cream" territory, had earned as high as 20 per cent on the investment. City officials state that the next step will be the calling of a bond election for the purpose of purchasing the Edison distribution facilities.

SAN FRANCISCO, CALIF.—Board of Supervisors and the Mayor have approved an ordinance which delegates to the Public Utilities Commission of the city and county of San Francisco authority to acquire by purchase or condemnation, or to construct, an electric light and power plant, and to issue bonds for the purpose. The supervisors hope to obtain a court test of the validity of the ordinance in time to submit a power distribution proposal to the voters at the November election.

STERLING, COLO.—Public Service Company of Colorado has been authorized by the Public Utilities Commission to exercise the new ten-year franchise granted to it by the city.

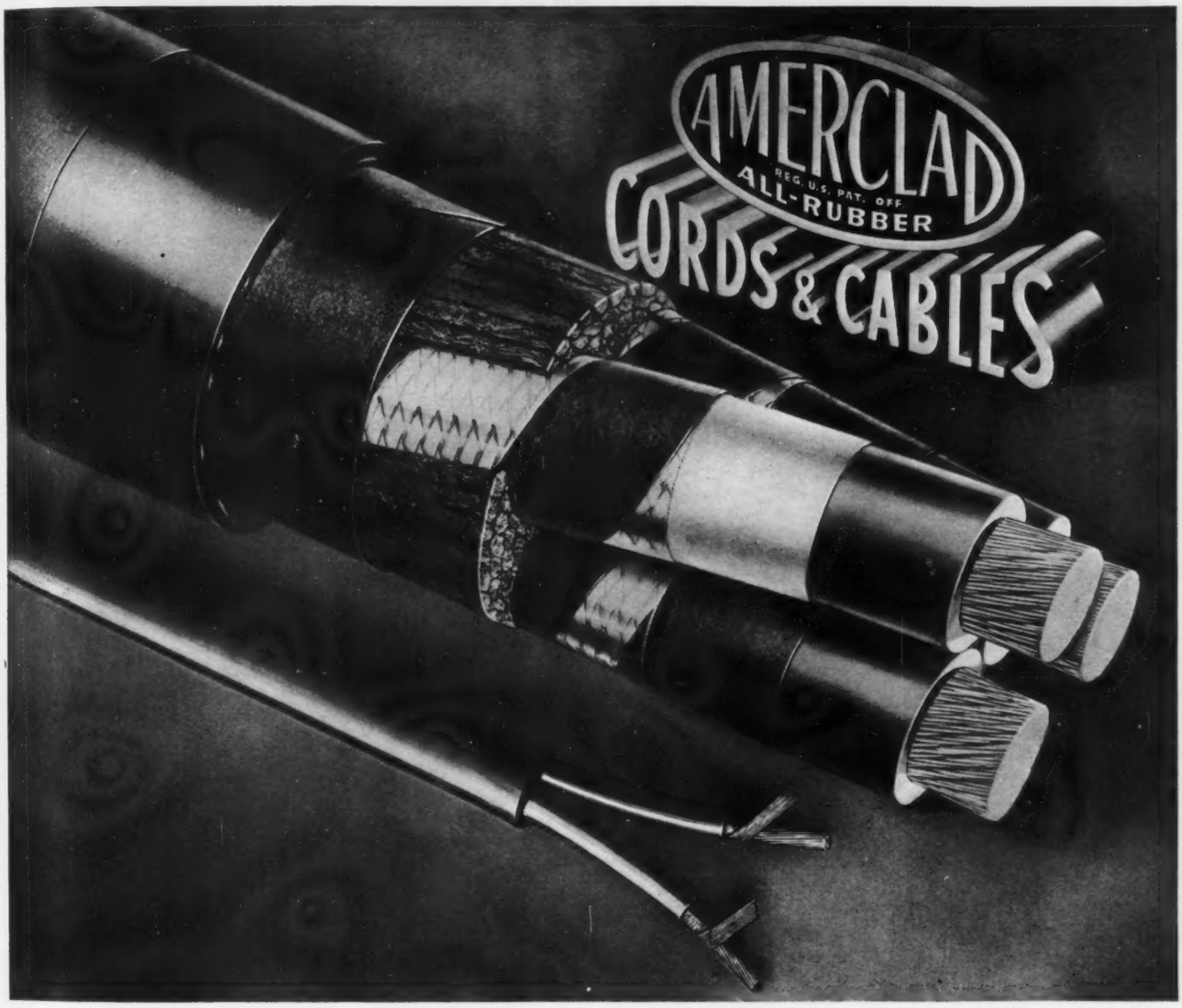
JACKSONVILLE, FLA.—An unsuccessful effort to bring about a rate reduction in electric power was made by Commissioner Ernest Anders in charge of the electric light department at a recent meeting of the commission. Commissioner Anders proposed a reduction in the commercial lighting rate from 7 cents to 6 cents per kilowatt-hour for the first 500 kw.-hr., from 6 cents to 5 cents for the next 2,000 and the next 2,500 at 4 cents. He estimated that some 6,000 consumers would benefit by the change. The loss in revenue, he explained, would be about $7,000 a month at first but expressed the belief that the reduction would stimulate consumption. The reduction was opposed at the commission meeting and sidetracked for further consideration.

ST. AUGUSTINE, FLA.—City has been advised by James E. Cotton, acting state director of the P.W.A. that if funds are made available for the power plant and distribution system for which the city has made application, the Power Division's recommendation would be for the project to cost $630,000 rather than $996,727 which was the amount named in the city's application. The grant contemplated from the government for the project would be approximately $174,000.

ROCKWELL CITY, IOWA—Proposed municipal light and power plant and distribution system for which this city voted $175,000 in revenue bonds (ELECTRICAL WORLD, August 1, page 118) has been indefinitely upheld because of litigation started by opponents of the project.

MONROE, LA.—A further reduction in domestic electric rates have been announced by William Rodriguez, commissioner of finance and public utilities. The schedule follows: One to 25 kw.-hr., 6 cents per kilowatt-hour; 26 to 100, 5 cents; 101 to 150, 4 cents; 151 to 200, 3 cents; 201 to 300, 2 cents, all over

Brothers under the Skin



"BIG boy" or "little fellow"—Amerclad All-Rubber Cords and Cables are always dependable. Their make-up includes a jacket as tough as the hide of a rhinoceros —that fights off water, muck, acids, oils and grease. They're brothers under the skin.

While Amerclad Cords and Cables and their component parts have high tensile strength, toughness and marked resistance to abrasion, flexibility is in no way impaired. Such combinations are rare and explain our unprecedented performance records. After all, there is no substitute for over 100 years of wire making experience in equipping a cable to "take-it" in the roughest going.

Our complete range of Amerclad Cords and Cables will meet your requirements.

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

Empire State Building, New York

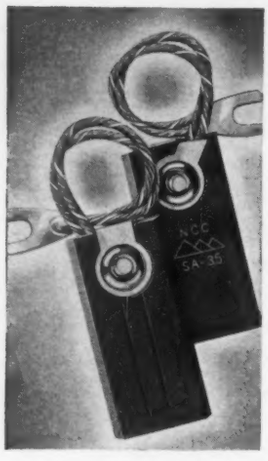
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

They must be ECONOMICAL

ELECTRICIAN: We want "SA" Series Brushes because they keep our maintenance costs low.

● Operators of electrical equipment watch overall costs—machine maintenance as well as brush cost. They specify "SA" Series Brushes because the five grades, with graduated performance characteristics, permit selection, for every machine, on the basis of good commutation, good brush life and low maintenance expense.



● "SA" Series Brushes are designed, primarily, to meet the severe demands of heavy duty service. This they do, successfully and economically. They also insure economy in the operation of all types of commutating equipment adapted to the use of electrographitic grades.

There is a National Pyramid Brush for every class of service

NATIONAL CARBON COMPANY, INC.
Carbon Sales Division, Cleveland, Ohio
Unit of Union Carbide UCC and Carbon Corporation
Branch Sales Offices: New York Pittsburgh Chicago San Francisco

300, 1 cent. The new schedule was effective August 1.

GLENCOE, MINN.—By a one vote margin a proposed municipal light and power plant was defeated in a special election held July 31. Northern States Power Company will continue to serve the city.

YAZOO CITY, MISS.—Revision of rates for meter service as proposed by the Public Service Commission has been announced and will probably go into effect September 1. The City Council has tentatively accepted the plan calling for lower rates.

COLUMBUS, MISS.—P.W.A. aid in financing the construction of a municipal electrical distribution system will be sought.

COLUMBIA, MO.—City has indefinitely postponed taking bids for various improvements to the municipal light and power plant to cost approximately $250,000. The city hopes to obtain a P.W.A. grant and loan to cover the cost, and will await action by the government.

THAYER, MO.—United States District Judge Albert L. Reeves at Kansas City on July 22 issued a temporary restraining order which prevents city officials from taking further steps in connection with the proposed construction of a municipal light and power plant and distribution system until such time as the court can conduct a hearing on the application of the Arkansas-Missouri Power Company for a temporary injunction against the city plant. Fairbanks, Morse & Company to whom the city has awarded the contract was also named in the suit.

MATTHEWS, MO.—Citizens recently voted the Missouri Utilities Company a twenty-year franchise to furnish electricity from its Sikeston plant.

TROY, OHIO—Readjustment of light and power rates of the local municipal plant has been approved by City Council. Large users of general light and power lines will benefit by the change, but heavy users of the special power lines will find their electricity bills higher, it is expected. The new ordinance sets the rate for general use at four cents per kilowatt-hour for the first 50 kw.-hrs., while all over this will cost three cents. Under the old rate the first 50 kw.-hr. cost 5 cents and all over 4 cents. The minimum charge of $1 remains unchanged.

ASHLAND, OHIO—In the face of agitation for a municipal light plant, City Council has passed an ordinance asking bids for street lighting and water works power for five-year and ten-year periods from the Ohio Public Service Company. An ordinance to submit a $750,000 bond issue to electors for a municipal light plant has been referred to committee.

PAULS VALLEY, OKLA.—In a recent special election, citizens voted to renew for 25 years the electric franchise of the Oklahoma Gas & Electric Company.

HENRYETTA, OKLA.—By a vote of 1,280 to 734, citizens defeated a proposal to renew for 25 years the franchise of the Public Service Company of Oklahoma.

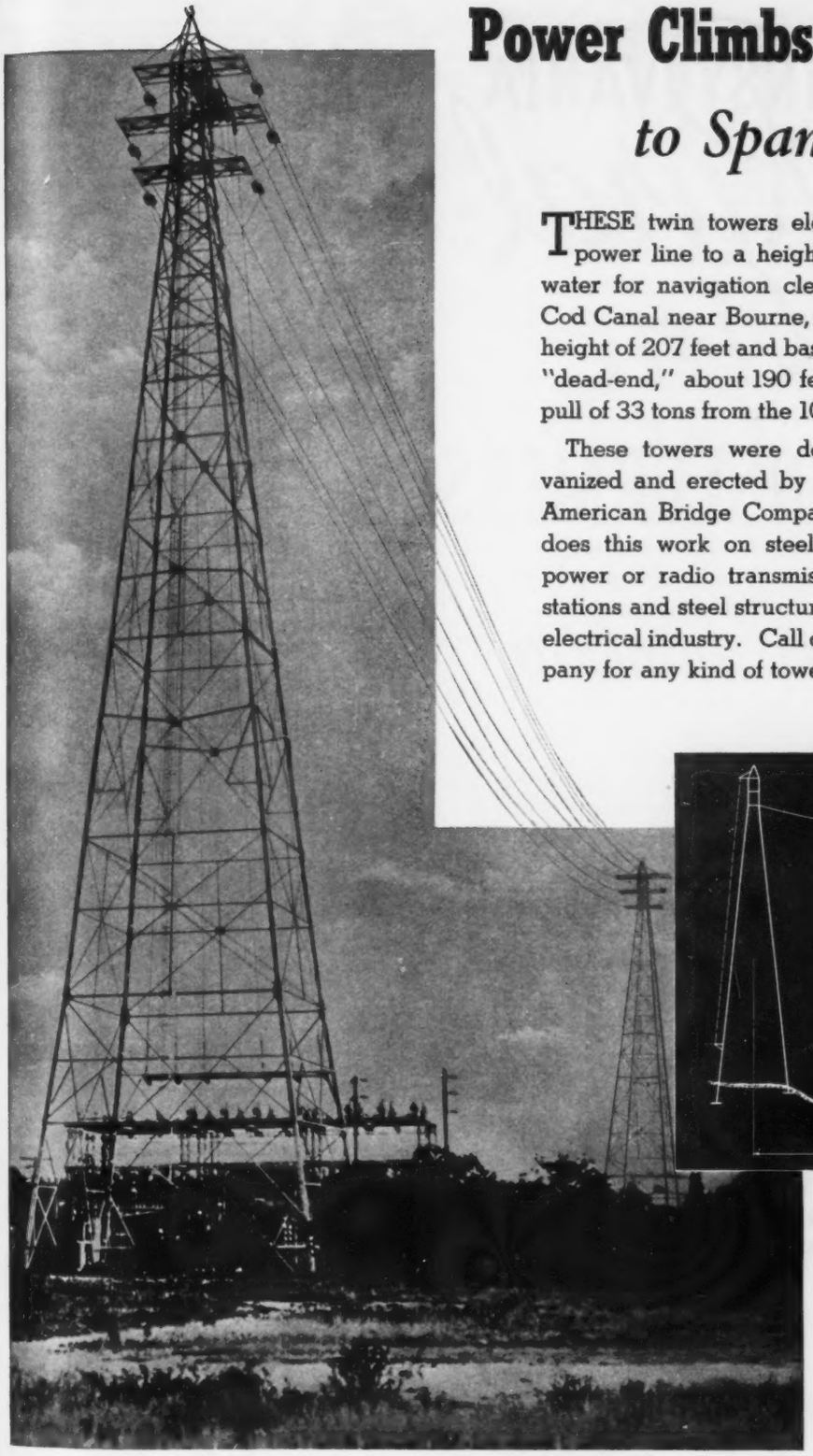
FLEETWOOD, PA.—Proposed municipal power plant project received a setback recently when Judge Paul N. Schaeffer declared invalid two ordinances passed by the Borough Council to pave the way for a $100,000 generating plant and distributing system. A taxpayer's bill in equity was filed to restrain the borough officials. The borough receives its electric energy from the Metropolitan Edison Company and steps had been taken to acquire the company's distributing system. Difficulties developed and the power company refused to sell. The borough then took steps to pass legislation to erect a distribution system in addition to the proposed power plant. Three taxpayers attacked the

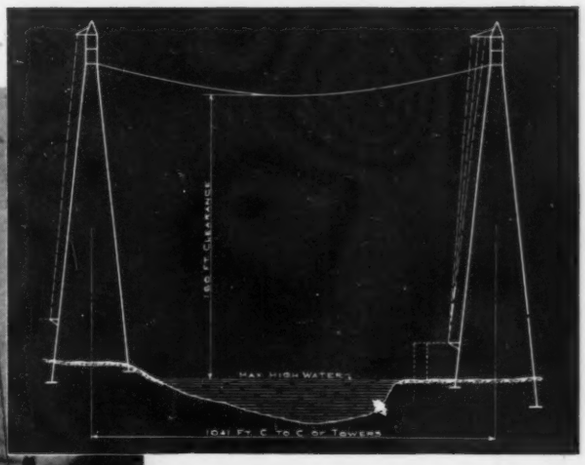
Power Climbs ABC Towers

to Span Canal

THESE twin towers elevate the double circuit power line to a height of 160 feet above high water for navigation clearance across the Cape Cod Canal near Bourne, Mass. Each tower has a height of 207 feet and base spread of 45 feet. They "dead-end," about 190 feet above ground level, a pull of 33 tons from the 1000 foot line span.

These towers were designed, fabricated, galvanized and erected by the tower department of American Bridge Company, a department which does this work on steel towers of all types for power or radio transmission, together with substations and steel structures for all branches of the electrical industry. Call on American Bridge Company for any kind of tower work.





(Above)—**Diagram shows navigation clearances provided by power line.**

. . .

(Left)—**Cape Cod Canal Crossing Towers near Bourne, Mass., built for the Cape & Vineyard Electric Company. Power Line elevated above the canal as future work on the channel made the laying of cables impractical.**

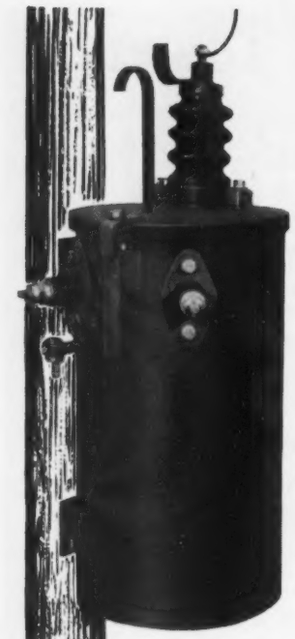
AMERICAN BRIDGE COMPANY

General Offices: Frick Building · Pittsburgh, Pa.

Baltimore Boston Chicago Cincinnati Cleveland Denver Detroit
Duluth Minneapolis New York Philadelphia St. Louis

Pacific Coast Distributors: Columbia Steel Co., San Francisco
Export Distributors: United States Steel Products Co., New York City

UNITED STATES STEEL



PENNSYLVANIA

Rural Line

TRANSFORMERS

● *of greater reliability*

The very nature of its installation requires a rural-line transformer to possess even greater reliability than an urban type. Hence, Pennsylvania Rural-Line Transformers embody all the characteristic advantages of other transformers bearing the Pennsylvania name, such as:

CIRCULAR COILS capable of withstanding severe short-circuit stresses without injury or distortion.

REINFORCED INSULATION which protects against high voltage surges of steep wave-fronts.

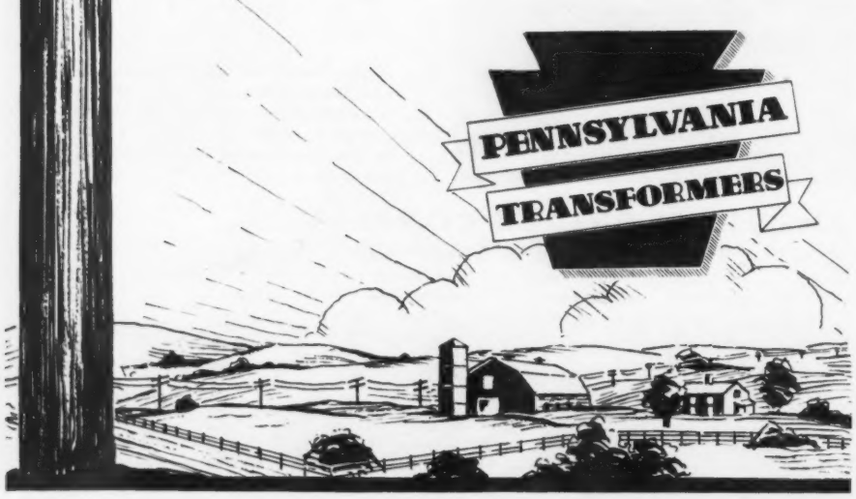
ROUND PRESSED STEEL TANKS, seamless, and of copper-bearing steel.

DETACHABLE BUSHINGS which are bolted externally and permit replacement without removing cover.

Indeed, Pennsylvania has called on its years of experience in designing this greatly improved, *more reliable* rural transformer!

Pennsylvania Transformer Co.

1701 Island Ave., N. S., Pittsburgh, Pa.



validity of the ordinances. The first ordinance was approved at a public election by a vote of 431 to 266. Later an amended ordinance was submitted and the injunction proceedings followed.

GAINESVILLE, TEX.—Recent election by taxpayers resulted unfavorably to a proposal to authorize the issuance of $418,000 of municipal revenue bonds for construction of an electric light and power plant. It was the second time in two years a referendum on that issue had been held. The City Council had obtained approval at Washington of an $188,000 P.W.A. grant to supplement a bond issue.

DANVILLE, VA.—City Council has reduced electric rates to city users which will mean a saving of from $10,000 to $15,000 per annum. The minimum rates are being dropped from $2.50 to 50 cents, which means that many small householders who hitherto have paid for energy they did not use will be benefited. E. C. Brantley, superintendent of utilities, recommended the new rate structure, holding that the profits made by the plant last year justified passing along the cut to users. The power rate remained untouched. The new rate became effective August 1.

YAKIMA, WASH.—A committee of business men and Henry Gray, consulting engineer, plan to submit a resolution to the city commissioners recommending that the city take over the power and light business and establish its own system.

SHULLSBURG, WIS.—Wisconsin Public Service Commission has set $18,000 as the price for which the city may acquire the local plant of the Interstate Light & Power Company. The commission allotted four months for completion of acquisition.

WITTENBERG, WIS.—Following an agreement between the village and the Wisconsin Power & Light Company, the Wisconsin Public Service Commission dismissed an acquisition proceeding which had been begun by the village in 1933. The commission held that the proceedings had been started under the wrong section of the statutes to permit of forced acquisition.

MEDFORD, WIS.—A value of $82,288 on the permanent property of the Lake Superior District Power Company was set by Louis J. Rust, Wisconsin Public Service Commission engineer, at a hearing before Chief Examiner W. A. Anderson on the city's action to acquire the plant.

POYNETTE, WIS.—Although they had previously voted in favor of acquiring the local distribution facilities of the Wisconsin Power & Light Company, voters in a recent special referendum turned down two methods of financing and purchase. An additional four months to acquire the plant was granted after it was testified that many voters had been confused by the questions at the referendum.

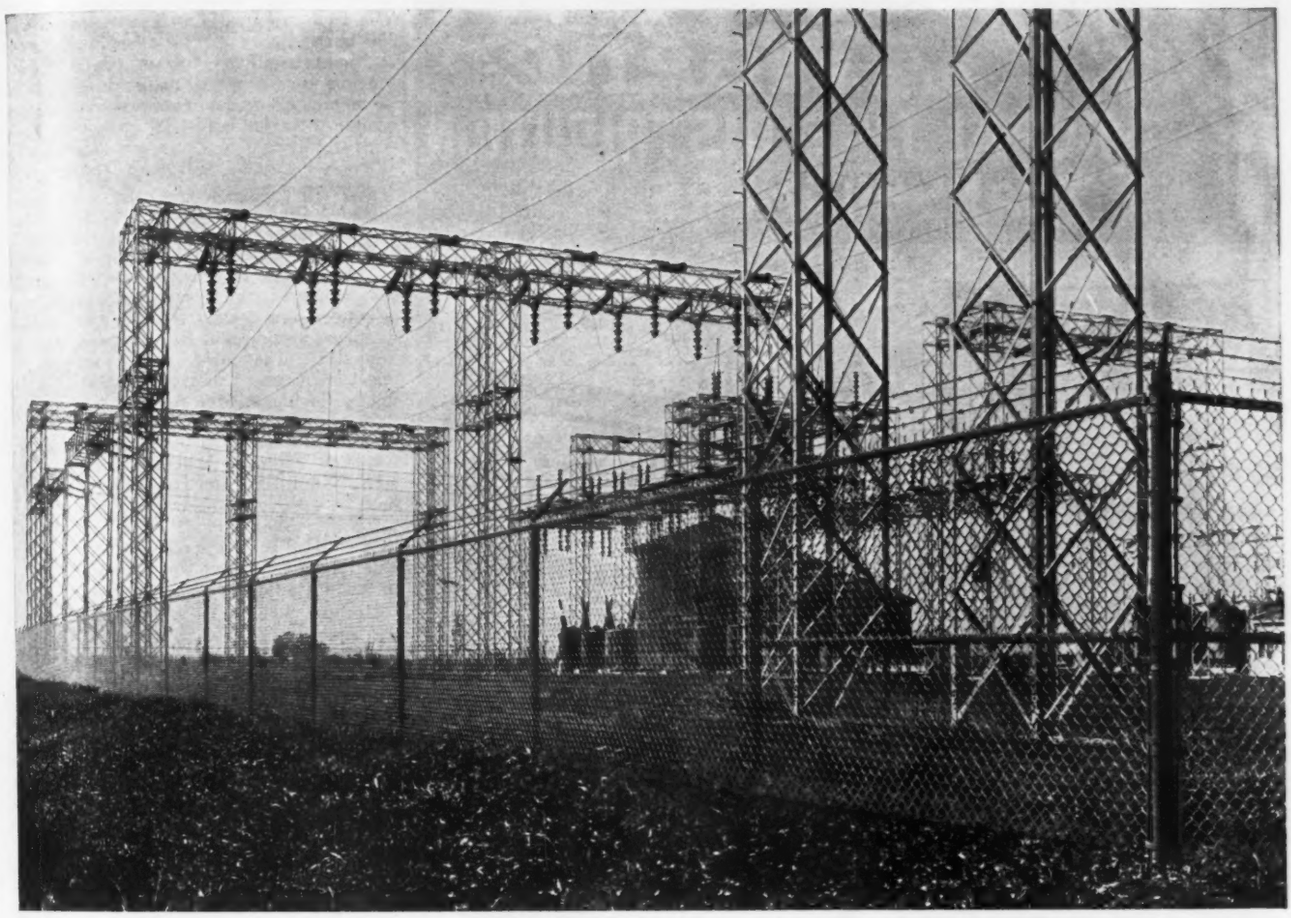
PARDEEVILLE, WIS.—Wisconsin Public Service Commission has fixed a price of $25,000 at which the city may acquire the Pardeeville Electric Light Company. The village first started acquisition proceedings in 1933.

●

English Electric Industry Makes Progress in 1935

According to the annual return of the Electricity Commissioners of England 250,000 electric cooking ranges went into service in 1935, 5,000 farms were electrified and there were about 500,000 new electrical consumers. Improved industrial conditions and railway electrification schemes may increase this figure to 1,000,000 in 1936.

Says "STAY OUT" and means it



YOUR valuable properties such as transformers, power houses, pumping stations and water supply need the sure protection of sturdy, unclimbable Cyclone Fence.

Trespassers, firebugs and thieves hate this famous fence. They know it means "stay out."

Saves Money

Cyclone Fence affords real, money-saving protection. It prevents destruction of property and other losses. It reduces insurance rates. And it is built to "stay put," with long-life quality features that save upkeep cost.

Immediate Delivery and Erection

We have big stocks of Cyclone Fence on hand in conveniently located warehouses all over the country. And our crews of trained men are ready to erect your fence at once.

Phone for prices and information

We will gladly send a representative to give you full information and estimates. There is no charge for this service. Write or wire us at Waukegan, Illinois, or phone our nearest office. Branches are located in principal cities.

Don't delay. Prompt action may save you money and worry.

CYCLONE FENCE

CYCLONE FENCE COMPANY

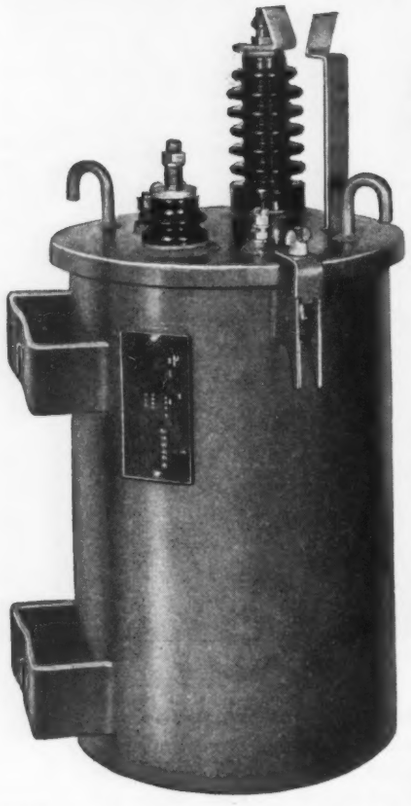
General Offices: Waukegan, Illinois · Branches in Principal Cities

Pacific Coast Division: Standard Fence Company, *General Offices:* Oakland, California

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Check These Six Points of Superiority of Wagner RURAL LINE DISTRIBUTION TRANSFORMERS



Service lines can be easily connected, since core and coils are fastened to cover and cover may be rotated to any desired position with respect to the pole.

No solder is required for connecting transformers to line—solderless connectors are used for all bushing terminals and grounding lugs.

Transformer is self-protecting against lightning as it is equipped with a co-ordinating gap that is set to flashover at a value well below the surge strength of the transformer windings.

Transformer is shipped filled with oil ready for service. This is made possible by the use of stud-type-bushings which eliminate all syphoning of oil.

Transformer is easy to hang — all that is necessary is to raise transformer so that the slotted mounting brackets slip over thru-bolts attached to the pole.

Hanger-irons and cross-arms for support are unnecessary, as mounting brackets are provided on tank for bolting transformer directly to the pole. Mounting brackets are so arranged that cross-arm hanger-irons can also be used, if desired.

Wagner type HEB-F rural line distribution transformers meet the need for a small inexpensive unit designed for application to lines of 13200 Y volts and below.

Transformers for this class of service are manufactured in the 1- and 3-kva sizes for operation on single-phase, 60-cycle lines where the high-voltage and low-voltage neutrals are interconnected and solidly grounded. All are oil-filled, self-cooled, 55° C. temperature rise. They are obtainable for voltage classes of 2400, 4800, 6900 and 7620 volts with solidly grounded neutral for operation on 4160, 8320, 11950 and 13200 volt lines.

Wagner Type HEB-F rural line distribution transformers have not only all these features, but many more. For further information regarding these transformers, write the nearest Wagner branch office. Descriptive literature will be sent upon request.

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U. S. A.

TD236-4B

Transformers *Motors* *Fans* *Brakes*

Recent Rate Changes

UNION ELECTRIC LIGHT & POWER COMPANY under new rate schedules filed with the Missouri Public Service Commission would reduce its charges to large light and power users, including wholesale untransformed and industrial power service, approximately $212,500 annually. The new rates would affect customers in all three classes in the Missouri territory served by the company. The Illinois Commerce Commission was asked to approve similar rates for industrial customers of the company in East St. Louis and vicinity. The Illinois customers will save approximately $138,000 annually.

ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER COMPANY recently asked the Missouri Public Service Commission for a rehearing of the rate case in which the commission last May directed the company to reduce its schedules downward. It is estimated the reductions would cost the company $336,380 annually. The lower rates were to take effect on August 1 and were based on a finding by the commission that the company rate base valuation is $4,350,000 on which it is entitled to earn 6½ per cent annually. The company contends that since the commission's appraisal and inventory conditions have so greatly changed as to cost of labor, materials, taxes and all other expenses that it is entitled to a rate effective Aug. 1, 1936, and thereafter based upon a fair valuation instead of the one the commission has set up.

DETROIT EDISON COMPANY'S rate charges and practices will be investigated at a general hearing before the Michigan Public Utilities Commission on September 21. William M. Smith, commission chairman, stated in announcing the hearing that a partial study of the company's rates had convinced him that a reduction could be made. The commission directed its engineering department and that of the company to make a new study of the company's rates and services and to be ready to testify at the hearing.

APPALACHIAN ELECTRIC POWER COMPANY has been ordered by the West Virginia Public Service Commission to give southern West Virginia a rate reduction which it is estimated will amount approximately to $850,000 a year. The reduction involves domestic, commercial, rural and large power users. The commission estimated the new schedules will save domestic consumers $366,497 a year, commercial and industrial consumers $93,580, large power users, $360,000, rural consumers, $5,231 and reduce municipal lighting rates by $31,500. The Virginia Corporation Commission has announced further reductions in the electric rates for residential and commercial customers in the territory served by the company in Virginia. The cut will amount to approximately $232,000 and more than 40,000 residential customers and 60,000 commercial customers will be benefited. The reductions resulted from negotiations by the commission with N. M. Argabrite, vice-president of the company and J. W. Hancock and Herbert Markle, managers of Roanoke and Bluefield, respectively.

COMMONWEALTH EDISON COMPANY has filed with the Illinois Commerce Commission a 415-page brief, charging that a reduction in electric rates is unwarranted and would be detrimental to the quality of service rendered consumers. A 335-page brief also was filed by the commission's legal staff. The Commonwealth Edison brief placed the fair valuation of the company's properties at $365,000,000. The company contends that it accepted decreased income during the depression and asked no rate increase until the additional 3 per cent Illinois public utility tax was passed in 1935. Since 1933 the company has been absorbing the federal 3

per cent electricity tax, amounting to about $1,500,000 per annum. The brief petitions the commission to permit an increase of rates sufficient to cover the Illinois tax. Even if this increase is granted, it is asserted that the company's net return will be less than 5 per cent. The Edison figure of $365,000,000 as a fair value of used and useful property compares with the figure of $255,000,000 to $265,000,000 set down by the commission. In its brief the utility contends that a fair rate of return should be not less than 7 per cent and preferably 7½ per cent, while the commission's staff urges 5½ per cent.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY of Baltimore, through Herber A. Wagner, president, has filed an answer to a recent complaint made to the Maryland Public Service Commission by the Commissioners of Baltimore County in regard to the cost of street lighting in the county. The company denies the claim made by the commissioners that the charges are excessive, unfair and unreasonable and asks that the complainant's petition be dismissed.

BRONX GAS & ELECTRIC COMPANY and YONKERS ELECTRIC LIGHT & POWER COMPANY beginning August 15 will send rebate checks to their consumers of electricity, the New York Public Service Commission has announced. The rebate checks will represent the difference between temporary rates established by the commission in the fall of 1934 and the rates collected by the companies between that time and the date of the recent Court of Appeals decision upholding the commission's order. The total refund, the commission stated, will amount to $805,000 after taking into account accrued interest at 6 per cent.

LACLEDE POWER & LIGHT COMPANY has filed with the Missouri Public Service Commission a reduction in rates affecting only large industrial consumers. If approved the new schedule will become effective immediately. The new schedule will result in a reduction of revenue of $35,000 annually.

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY has applied to the Wisconsin Public Service Commission for a modification of power rates effective for large power consuming industries. The modifications would have the effect of reducing the rate charge on the basis of the amount of power consumed.

KENTUCKY UTILITIES COMPANY has announced an electric rate reduction which will save customers approximately $75,000 annually in 182 communities. In a majority of places the new rates became effective with August 1 bills, and in other communities as soon afterward as possible.

ORANGE & ROCKLAND ELECTRIC COMPANY has field revisions of its general service rate for electricity with the New York Public Service Commission which are estimated to save consumers about $16,000 annually.

•

Air Conditioning Sales Up

Representatives of air-conditioning concerns in Detroit report that sales have picked up sharply in the past couple of weeks, especially for office and small shop use. While it is yet too early to measure the extent of business currently being done, except to say that it is far better than a year ago, belief is that enough business is being obtained to require considerable manufacture at factories.

CHASE

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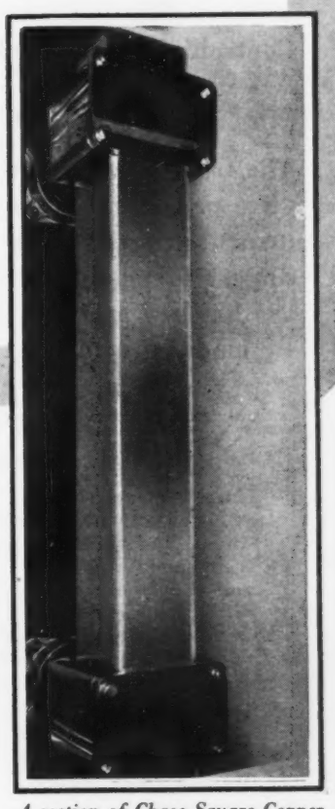
SQUARE COPPER TUBE
for
HEAVY DUTY BUSES



This new Chase development for heavy alternating currents has many advantages in efficient bus construction. It is seamless, hard-drawn copper tube, square in shape, and either ventilated or unventilated, depending on conditions to be met. All necessary fittings for supporting the tube and making connections are available.

A section of Chase Square Copper Tube bus construction installation

Efficient . . . Rigid . . . Economical

For equivalent duty, the use of square copper tube effects a saving over flat bar construction, both in the amount of copper required and in the number of fittings necessary for an installation. The tube is rigid in all directions, hence spans can be longer between supports. Installations are neater and more compact.

Refer your special conductor problems to our engineers who will furnish complete engineering information on applications and installations of Chase products.

For further information about Square Copper Tube and other Chase developments in the electrical field, send the coupon below.

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MAIL THIS COUPON
for your free copy of our 40-page engineering handbook, complete with technical information, tabular data and engineering specifications.

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WEYERHAEUSER RESPONSIBILITY

Controlling pole production from stump to line the Weyerhaeuser Pole Company has absolute supervision over the timber selected for today's power lines.

The trees from Weyerhaeuser privately owned stands are "live peeled" and properly seasoned by experienced pole men. Inspections are frequent and rigid. Careful handling and loading forestalls unnecessary damage. They are finished and butt treated under rigid inspection and by modern methods.

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How Weyerhaeuser poles are cut, seasoned, and processed is a story interesting and vital to every buyer. A booklet describing the methods in detail will be mailed free on your request.

You add economical performance to your lines when you install Weyerhaeuser poles.

You can build new lines and modernize the old with Weyerhaeuser Poles, secure in the knowledge that they will give you years of low-cost satisfactory service.

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WEYERHAEUSER WESTERN RED CEDAR POLES

SALES OPPORTUNITIES IN NEW CONSTRUCTION

CASPER, WYO.—Bureau of Reclamation, Denver, Colo., receives bids until August 27 for two vertical shaft 12,000-kva., a.c., electric generators, with accessories; two vertical-shaft 15,000-hp. hydraulic turbines, with auxiliary equipment, including two governors with pumping machinery for speed regulation, for installation by the Government in Seminoe power plant, Casper-Alcova Project, Wyo. (Specifications 691).

CATLETTSBURG, KY.—Carbide & Carbon Chemical Corporation, 30 East Forty-second Street, New York, N. Y., subsidiary of Union Carbide & Carbon Corporation, same address, plans installation of heavy-duty motors and controls, regulators, transformers and power substation apparatus, electric hoists, conveyors and other equipment in new multi-unit plant near Catlettsburg, where large tract of land has been acquired. A compressor plant will be built for natural gas supply for plant, which will convert such gas into liquid form as a feature of production. Entire project will cost over $1.000,000.

OMAHA, NEB.—Nebraska Power Company will carry out expansion and improvements at local steam-electric power plant, Fourth and Jones Streets, over a period of months, to cost in excess of $1,400,000. Work will include installation of 12,000-kw. turbo-generator unit, with accessories, high-pressure boiler and auxiliary equipment. Building permit has been taken out for immediate construction, as recently noted in these columns. Plans have been approved also for new power substation on Leavenworth Street.

BUFFALO, WIS.—Buffalo County Electric Co-operative Association, Buffalo, recently organized, plans transmission and distributing lines for rural electrification in parts of Buffalo and Trempealeau Counties, totaling 250 miles, with service facilities. Fund of $260,000 has been secured through Federal aid. E. B. Wayte, Wisconsin Rural Electrification Authority, Capitol Building, Madison, Wis., is engineer.

BARTLETT, TEX.—Belfalls Light & Power Company, care of William G. Morrison, Bartlett, engineer, in charge, has concluded arrangements for Federal financing in sum of $450,000 for electric power station and rural electrification project. Latter will include about 300 miles of transmission and distributing lines in parts of Bell, Falls and Milam Counties. Power plant will be of Diesel-electric type, on site near Bartlett. Proposed to begin work soon.

VICKSBURG, MISS. — United States Engineer Office, Vicksburg, receives bids until August 20 for two gasoline engine-driven electric generating sets (Circular 28).

BELLEVILLE, N. J.—Wallace & Tiernan Company, Inc., Mill Street, plans installation of motors and controls, conveyors and other equipment in two new additions to liquid chlorine control apparatus manufacturing plant. Cost over $125,000. Fletcher-Thompson, Inc., 1336 Fairfield Avenue, Bridgeport, Conn., is consulting engineer.

RED OAK, IOWA—Iowa-Nebraska Light & Power Company, Lincoln, Neb., plans transmission and distributing lines for rural electrification in vicinity of Red Oak, totaling about 17 miles. Application has been made for permission.

EL DORADO, ARK.—Lion Oil Refining Company plans installation of motors and controls, electric pumping machinery, conveyors and other equipment for expansion in lubricating oil production division. Cost close to $100,000.

WASHINGTON, N. C.—Plans extensions and improvements in municipal electric power plant. Proposed to begin work soon. Fund of $64,000 has been secured through Federal aid.

HARLAN, IOWA—Shelby County Rural Electric Co-operative, Inc., Harlan, recently organized, plans transmission and distributing lines in parts of Shelby, Harrison, Cass and neighboring counties for rural electrification, totaling 250 miles, with service facilities. Bids for construction scheduled to be asked soon. Fund of $267,000 has been secured through Federal aid.

SPRAGUE RIVER, ORE.—California-Oregon Power Company, Medford, Ore., plans early construction of 60,000-volt transmission line from Sprague River to Bly, about 22 miles, including construction of new power substation at last noted place, to be used largely for power supply to lumber mills in that district. Plans are under way also for new 11,000-volt primary line to Midland Community area, Lower Klamath Lake, about 6 miles, with power substation facilities.

WASHINGTON, D. C.—General Purchasing Officer, Panama Canal, Washington, receives bids until August 24 for six potential transformers; one three-phase, 37½-kva. distribution type transformer; 100,000 feet of copper wire, 2,000 feet of copper cable, 25,000 feet of copper cord; 100 eight-circuit panelboards, and 30 16-circuit panelboards; eight watt-hour meters; quantity of telephone cable, telephone cable terminals, time switches, safety type switches, primary cutouts, etc.; 279 electric-lighting fixtures and other electrical equipment (Schedule 3172).

TARRYTOWN, N. Y.—Chevrolet Motor Company plans installation of motors and controls, regulators, electric hoists, conveyors and other equipment in new additions to local assembling plant, including Fisher Body Division works. Cost close to $350,000. Company headquarters are at 3044 West Grand Boulevard, Detroit, Mich.

COLUMBIA, S. C.—State Rural Electrification Authority, 1539 Main Street, Columbia, receives bids until September 1 for complete materials, equipment and construction of 194 miles of single-phase and 16 miles of three-phase electrical distributing lines in different districts of State for rural electrification, including area in vicinity of Spartanburg, Greenville, Pickens, Darlington, Hampton and other points, all forming part of State Project No. 1.

WELLINGTON, KAN.—Will take bids soon for extensions and improvements in city-owned electric power plant, including new turbo-generator unit and auxiliary equipment. Fund of $127,000 has been secured through Federal aid. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

CAMARILLO, CALIF.—State Hospital Department, George B. McDougall, Public Works Building, Sacramento, Calif., state architect, in charge, plans installation of motors and controls, conveyors and other equipment in group of six buildings for new dairy products plant at State Hospital, Camarillo, for which bids on general contract, including electrical installation, are being received until August 26. Estimated cost over $100,000.

PAYETTE, IDAHO—Bureau of Reclamation, Denver, Colo., receives bids until August 21 for five motor-driven centrifugal pumps with auxiliary equipment for heavy-duty service, with capacities of two units 45 second-feet each; two units, 38 second-feet each; and one unit, 10 second-feet. Equipment will be installed by Government at Payette-Oregon slope pumping station. Owyhee Project, Oregon-Idaho (Specifications 819-D).

DO YOUR CURRENT TRANSFORMERS HAVE THESE *Advantages*

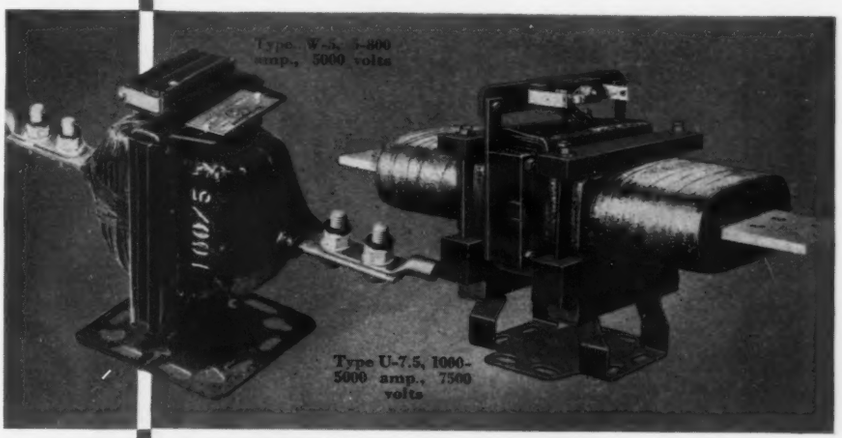
1 **Hipernik cores that assure exceptionally high accuracy. Hipernik is a non-ageing alloy with three times the permeability of the best silicon steel and but one-half the losses.**

2 **Insulation that withstands dynamic and lightning surges.**

3 **Interchangeability of all current ratings in the same voltage class.**

4 **Secondary terminal block with automatic short-circuiting feature.**

5 **Mounting feet arranged for either flat surfaces or transverse and parallel-pipe frame-works by means of U bolts.**



These are just a few of the many outstanding advantages of Types W and U Current Transformers. These Westinghouse transformers are designed for metering applications at frequencies between 25 and 133 cycles, and on lines up to and including 23,000-volts.

For more detailed information, ask for Catalog Section 45-110. J 70025

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ROME-CABLE
ROME, N.Y.

Knowing so well the needs and requirements of our customers, we have installed in our new mills carefully designed and modern equipment to produce the uniform and high quality product so necessary in a multitude of uses.

Always glad to ship trial orders so the product may be tested in use and register its excellence.

We will be pleased to quote on your requirements covering

HOT ROLLED COPPER RODS

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(in rounds, flats & squares)

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SALES OFFICES:
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Imports to Peru Increase in 1935

As a result of improved economic conditions in Peru, the demand in that market for electrical goods substantially increased in 1935, a report to the U. S. Commerce Department from its Lima office shows.

Not including electrical machinery and lighting plants, Peruvian imports of electrical goods in 1935 were valued at 6,642,122 sols ($1,590,000), an increase of 2,152,329 sols ($516,000) as compared with the preceding year. The United States and Germany, the report shows, are the chief sources of supply for electrical goods.

Peruvian importers of electrical goods, the report states, are optimistically inclined as regards the outlook for their business in the immediate future. The demand for refrigerators, fans, household appliances and radios during the first quarter of this year registered notable improvement over the corresponding period of 1935.

•

Electricity Extensively Used in Canadian Industry

The ratio of electric motor capacity to total power employed in manufacturing industries in Canada has increased steadily from 1923, with only two small recessions, and for 1934 was 78.5 per cent. Many industries use electric drive exclusively and scores of others have ratios above 90 per cent. This rise from 61.3 per cent in 1923 to 78.5 was effected largely by the pulp and paper mills.

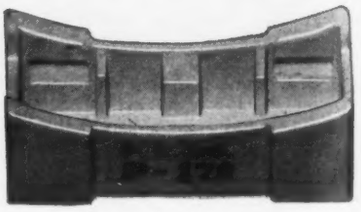
The mining industries in Canada are nearly as completely electrified as the manufacturing industries, with the exception of the fuel group, and the increase in the ratio of electric motors to total power equipment during these eleven years has been even greater, rising from 57.3 per cent in 1923 to 75.1 in 1934.

•

Kelvinator Develops Air Conditioning for Buses

Bus passengers will soon find distances shortened as a result of the development by Kelvinator Corporation of complete air conditioning for motor coaches. Installed in the White "Dream Coach" on exhibition at the Great Lakes Exposition at Cleveland, this new adaptation of air conditioning marks a high in transportation comfort. It is expected that this innovation will permit greater distances between rest stops. On long trips reduction in the number of stops will mean considerable saving in time.

THE STAR METER SEAL
MAKES METERS TAMPERPROOF



A simple, inexpensive porcelain cap that seals all type CS meters effectively and permanently—*cannot be removed without completely destroying or badly mutilating it.* Write for sample and details.

We make porcelain for all electrical insulating needs—for decorative purposes.

THERMOLAIN
Heat Resistant Refractory

Thermolain is a porous porcelain of good mechanical strength — an excellent refractory for ranges, heaters, irons, rheostats, immersion heaters, etc., where rapid changes of temperature occur.

LAVOLAIN
for Mechanical Strength

A dense, heat-resistant insulation—recommended for bushings, coils, rods and other parts requiring mechanical strength and for ovens, toasters and other equipment where high dielectric strength at high temperatures is necessary.

We make a number of porcelains for many purposes—can supply the exact material and part you need to give maximum service. Write us.

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TRENTON, N. J.

BOOK REVIEWS

Principles of Radio Engineering

By R. S. Glasgow. Published by McGraw-Hill Book Company, 330 West 42d Street, New York City. 520 pages, illustrated. Price, $4.

The electrical student is here inducted promptly into resonant, coupled and oscillatory circuits. Tubes in their fundamental aspects follow and then come their adaptation to audio and radio circuits. Subsequent sections deal with oscillators and amplifiers and modulation. Detectors and recovery systems precede the treatment of antennas and wave propagation which close the book. Any one who has had the conventional electrical engineering course should find this Washington University author's approach to radio engineering principles facile and lucid. The mathematics is not advanced.

•

Public Utility Financing 1930-35

By Merwin H. Waterman. Published by Bureau of Business Research, University of Michigan, Ann Arbor. 144 pages, illustrated. Price, $1.

Participation as an employee in customer-ownership drives seems to have inspired this study of depression financing as a continuation of other studies. After comprehensive analysis, the author finds that the investment trust is the next evolutionary stage of the holding company with operations outside equity financing hard to justify. Anyhow, ". . . neither law nor custom provides corporate pensions on which holding companies can retire after they have served their lives of economic usefulness. . . ." Help-in-time-of-need financing is found to be largely a matter of lending back dividend and interest abstractions. A better case is shown for the stabilization and diversification attributes of the holding company.

Argument is calm and persuasive and the statistics are ample for support of the generalizations to the extent contemplated by the author.

•

Study of the Interruption of Medium Power Electric Circuits

By Janes Anderson. Published by Allday Limited, 128-130 Edmund Street, Birmingham 3, England. 139 pages, illustrated. Price, $26.35.

This book, "a plain tale from the test room" according to the author, covers a number of tests on the interruption of medium power circuits conducted intermittently over a period of years from 1914 to the present. The only instruments used in recording data were camera, voltmeter, ammeter and a foot rule. For the most part this text is pictorial. Some 3,000 photographs of arcs corresponding to between 20 and 11,000 amp. at about 400 volts a.c. and d.c. are presented, together with charts and comprehensive information on arc formation and suppression in air, oil and water. Slow and quick breaking with inductive and non-inductive loads and the effects of a.c. and d.c. magnetic blow-outs under different conditions are considered at some length.

Throughout this work, which is extensively illustrated, evidence of the camera has been placed before all else. In many in-

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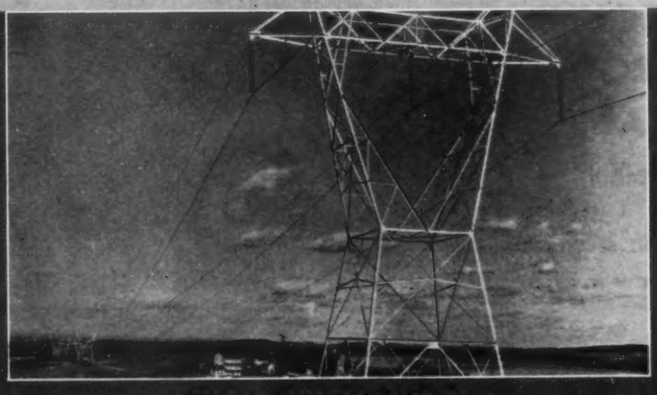
for
PUBLIC UTILITIES



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The fact that Blaw-Knox Products are in accord with the rigid standards of Public Utility purchasing is proof not only of the merit of the products themselves but of the house behind the products.

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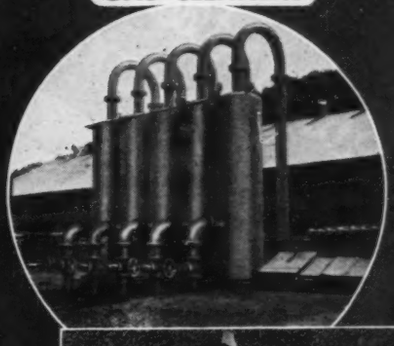
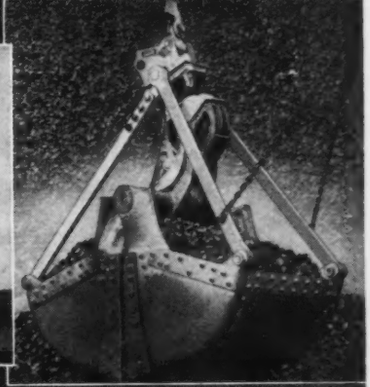
GAS CLEANERS



STEEL BUILDINGS



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Reliable

GROUND ROD CLAMPS

Withstand corrosion
High in strength
Very low in price

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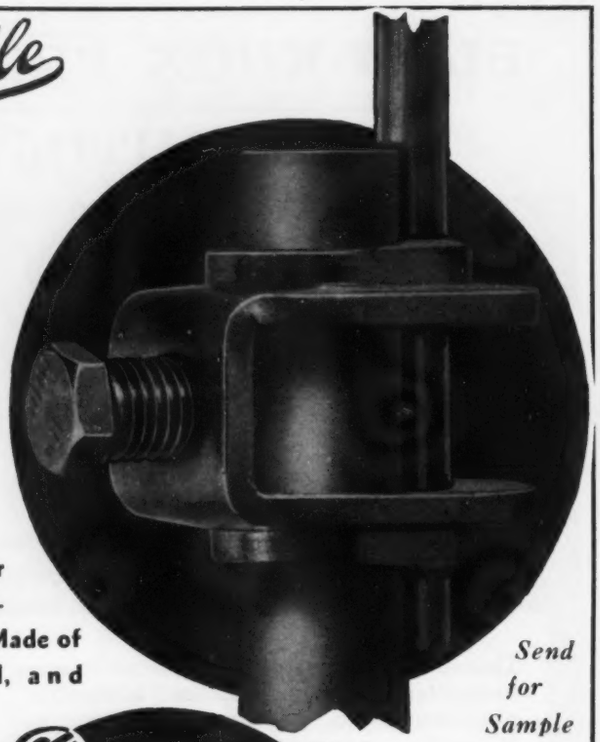
Made of Everdur for Copper and Copper-weld ground rods. Made of Steel, Galvanized, and Tinned, for steel ground rods.



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This is proved by field tests made periodically since 1921 . . . in widely separated areas representing varied soil and climatic conditions. To date, the groundline area of every P & H PROCESS Pole inspected was found to be as sound as the day it was set.

Prompt shipment on all cedar pole requirements.

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WESTERN RED... NORTHERN WHITE CEDAR

P&H

"Still in the Lead"

stances, however, the author finds some trouble in drawing definite conclusions from his tests. Switchgear designers, students and switchgear users should find this book instructive and useful. It has a distinct appeal to the "practical man" because of the absence of "highbrow theory."

•

The Chemistry of Synthetic Resins

By Carleton Ellis. Two volumes. Reinhold Publishing Corporation, New York. 1615 pages, illustrated. Price, $19.50.

In electrical manufacture and in applied electrical engineering synthetic resins and plastics have gained a large place and are of increasing importance. This very thorough and complete work by Mr. Ellis is badly needed to give a text on the subject useful to students, chemists and engineers. It gives a balance in scientific, technical and practical treatment. It covers all the classifications of resins, plastics and molded materials, giving their chemistry, production, characteristics and applications. It is replete with references. This is a splendid contribution to the literature.

•

Neon

By S. Gold. Distributed in U. S. A. by Chemical Publishing Company, of New York, 175 Fifth Avenue, New York City. 176 pages. Price, $4.50.

Practical aspects of preparing and exhausting neon tubing, shaping the letters, mounting them and determining their electrical requirements as to transformers, voltage and watts are given prior place in this British text. Technical language is saved for later sections on conduction and the tube characteristics. Other portions deal with commercial practicalities like estimating and merchandising. Glass-bending requirements as well as pumps are also discussed. Power-factor correction and condensers and life factors likewise are accorded appropriate space in this book for architects, contractors, power salesmen and illumination practitioners.

•

Engineering Valuation

By Anson Marston and Thomas R. Agg. Published by McGraw-Hill Book Company, 330 West 42d Street, New York City. 655 pages, illustrated. Price, $6.

Equally well adapted to field and class use, this book is almost encyclopedic in its presentation of theoretic principles, mathematical data, field compilations and case treatments of engineering valuations. In so controversial a subject, one would expect to find some considerable measure of opinionation, but on the contrary, the authors succeed in presenting all the aspects and schools with minimum bias. The foundation and objective of valuation are correlated with the technique of ascertaining and fixing a substantial value. In the evolution of the subject, the adjudicated principles are traced, and here is where the valuation engineer will find the book unusually valuable because it gives a condensed summary of all the ruling court decisions.

The actuarial treatment of mortality and of depreciation is extensively handled in clear and concise manner, although some experts will surely differ in regard to certain abstruse definitions of valuation and accounting terms. The book is crammed with tabular and graphic information on the

mathematical manipulation of valuation quantities. Price trends and life factors, along with a compilation of recognized price indexes, are a distinctive feature of the work. A chapter deals with overheads and intangibles, another with liquid funds, still another with land. Industrial properties are accorded a chapter as well as electric utilities. Elaborate appendices give experience and computed data on service lives, mortality type curves and actuarial compounding tables at several values of interest up to 8½ per cent. The authors are deans of engineering at Iowa State College.

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Practical Air Conditioning

By Harold L. Alt. Domestic Engineering Company, 1900 Prairie Avenue, Chicago. 269 pages, illustrated. Price, $1.

Language used in evening trade school classes is used here so the uninitiated contractor can dodge abstruse thermodynamics and still install air conditioning satisfactorily in homes, offices and commercial establishments. Only simple arithmetic is employed and technical data have been reframed to a lay level. Many an air-conditioning salesman will lend this book to his prospects so they can confirm their faith in his claims and promises. The expert might, however, take exception to some of the short cuts and liberties and the author expects just that. Fans, motors, controls and ducts are given independent chapters.

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Electrician Annual Tables of Electricity Undertakings

Published by Benn Brothers, Ltd., Bouverie House, Fleet Street, London, England. 241 pages. Price, 10s. net.

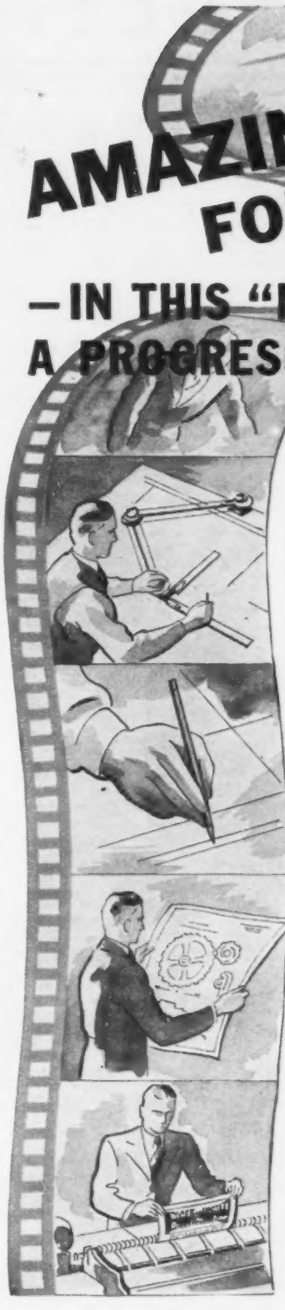
The 1936 edition is the 49th annual issue of this excellent compilation. Like its forerunners, it is an invaluable work of reference regarding establishments for the supply of electrical energy in Great Britain, her dominions and colonies. In addition 23 pages are devoted to the service in some 200 foreign cities throughout the world. Four introductory pages (9¾x12 inches) are given to a description of the present status of the National Power Scheme—the "Grid"—including a tabulation of stations, owners, rates and a full-page map. The statistical data go into greater detail than is found in comparable publications in the United States, usually including such items as the connected load, the peak demand, boiler plant, prime movers, generators, transforming and converting plant, year's output, rates for energy, voltage, frequency and number of consumers.

•

Diesel Electric Plants

By Edgar J. Kates. American Technical Society, Drexel Avenue at 58th Street, Chicago. 181 pages, illustrated. Price, $2.

Not professing to be a technological treatise on Diesel-electric plants, this little book does give, for elementary students and operators, a fairly comprehensive insight into the rudiments of plant apparatus requirements, operation and upkeep. Much is said of voltage regulators, thus inadvertently damaging the claim of "cheap electric power" with reliability and adequate quality of output. Several makes are described in discussing the various forms of automatic and auxiliary features required as adjuncts of the small Diesel plant. There is a short chapter on Diesel-electric locomotives and articulated trains. Some sections will irritate those who have tried to make a living out of power sales.



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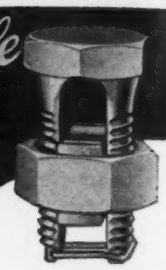

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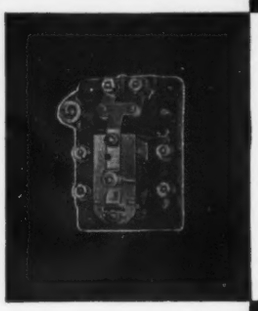

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